PLAINTIFF'S EXHIBIT
CAP-207

CAUSE NO. 10346*BH99

DONALD R. KINSEY et al.	§	IN THE DISTRICT COURT
	§	
Plaintiffs,	§	
	§	
v.	§	BRAZORIA COUNTY, TEXAS
	§	
OWENS-CORNING (CORP.)., *et al.*	§	
	§	
Defendants.	§	23RD JUDICIAL DISTRICT

DEFENDANT CAPCO'S RESPONSES TO PLAINTIFFS' REQUEST FOR PRODUCTION ACCOMPANYING THE DEPOSITION NOTICE FOR A CORPORATE REPRESENTATIVE

COMES NOW CAPCO Pipe Co., Inc. ("Capco") and responds as follows to Plaintiffs' Request for Production accompanying the Deposition Notice for a Corporate Representative.

GENERAL OBJECTIONS

1. Capco generally objects to any document request, definition, or instruction that purports to require Capco to respond to any discovery request in a manner or to an extent not required by the Texas Rules of Civil Procedure.

2. Capco objects to any document request which seek information protected by any privilege, including the attorney-client and/or attorney work product privileges.

3. Capco objects to any document request to the extent that it seeks information regarding trade secrets, confidential financial data, or other proprietary information.

4. Capco objects to any document request to the extent that it seeks information that is not within the personal knowledge of Capco or its current officers.

5. Capco generally objects to plaintiffs' requests for documents to the extent that such documents are not in Capco's possession, custody, or control.

6. Capco objects to any document request that seeks information that is not relevant to the subject matter involved in the pending action, that is not reasonably calculated to lead to the discovery of admissible evidence, that was prepared in anticipation of litigation or for trial by or for Capco's representatives, including attorneys, consultants, and agents, or that are otherwise

beyond the scope of discovery permitted by the Texas Rules of Civil Procedure. Accordingly, Capco objects to any requests for documents after 1968, the year that Plaintiff Kiker alleges exposure to Capco pipe. Capco also objects to producing herewith documents that have previously been produced in this litigation.

7. Capco generally objects to any document requests seeking information as to entities other than Capco on the grounds that such requests are overly broad, unduly burdensome, and seek information that is neither relevant nor reasonably calculated to lead to the discovery of admissible evidence.

8. Where Capco otherwise responds to a document request, it does so by incorporating each of these General Objections by reference into each individual response, without waiving any of its stated objections.

SUBJECT TO the foregoing objections and limitations which are applicable to each of the numbered paragraphs of the Request for Production, and subject to any documents being in existence and recoverable through a reasonably diligent search, Capco further responds to the individual Request for Production without waiver and with preservation of:

a. The right to object to the use of any documents, or the subject matter thereof, on any ground in any proceedings in any action (including any trials);

b. The right to object on any ground at any time to a demand or request for a further response to the discovery request or to any other documents, or other discovery involving or relating to the subject matter of the discovery requests herein responded to; and

c. The right at any time to revise, correct, add to, supplement or clarify any of the responses to the individual Requests for Production.

OBJECTIONS TO DEFINITIONS

1. Capco objects to plaintiff's definition of "Defendant", "You", "Your", and "Your company" to the extent that it includes entities that are not parties. Capco further objects to this definition to the extent it includes former officers, directors, agents and employees over whom Capco no longer has dominion and control. By way of further objection, the use of these definitions transforms plaintiffs' request for production into an overly broad, unduly burdensome fishing expedition and is, therefore, in violation of the Texas Rules of Civil Procedure.

2. Capco objects to plaintiff's definition of the words "document" and "documents" to the extent it includes information protected by privilege, including the attorney-client and attorney work product privileges. Capco further objects to this definition to the extent it includes documents which are no longer in Capco's possession and which, consequently, cannot be produced. By way of further objection, Capco objects to this definition to the extent it includes documents from entities which are not named defendants.

3. Capco objects to plaintiff's definition of the words "person" and "persons" to the extent it includes entities that are not parties. Capco further objects to this definition to the extent it includes former officers, directors, agents and employees over whom Capco no longer has dominion and control. By way of further objection, the use of these definitions transforms plaintiffs' interrogatories and request for production into an overly broad, unduly burdensome fishing expedition and is, therefore, in violation of the Texas Rules of Civil Procedure.

4. Capco objects to plaintiff's definition of the following words and/or phrases as these definitions are misleading and/or inconsistent with the customary and usual definitions of the word or phrase: "meeting or meetings," "describe or description," "distribute, distributed, distributor and distribution", "marketed and market", "medical advisory capacity", "manufacture or manufactured", "medical department and safety department", "potential health hazards or health hazards", "identify," "product containing asbestos fibers, asbestos containing products, asbestos products, substance and asbestos materials." These definitions are further objected to on the grounds that they are overly broad, vague, ill-defined and not susceptible to precise response.

REQUEST FOR PRODUCTION NO. 1: Any and all documents related or pertaining to acquisition by Defendant or any predecessor or subsidiary or related company of the assets, stock, property, rights, holdings or liabilities of each and all of those entities.

To the best of Capco's present knowledge, no such documents exist.

REQUEST FOR PRODUCTION NO. 2: Any and all documents related or pertaining to the assignment or lack thereof of any assets and liabilities by Defendant's predecessors or subsidiaries to Defendant or to any predecessor, successor, subsidiary or related company, any and all documents related or pertaining to the potential liability of Defendant for the sale, manufacture, marketing and/or distribution of asbestos products by Defendant and its related entities.

To the best of Capco's present knowledge, no such documents exist.

REQUEST FOR PRODUCTION NO. 3: Any and all documents related or pertaining to any judicial decision on the issue of Defendant's liability for the acts of any subsidiaries or predecessors.

To the best of Capco's present knowledge, no such documents exist.

REQUEST FOR PRODUCTION NO. 4: All documents in Defendant's or any subsidiary's possession relating to insurance coverage proceeds that would or could indemnify Defendant for any losses sustained as a result of a cause of action brought by Plaintiffs.

To the best of Capco's present knowledge, no such documents exist.

REQUEST FOR PRODUCTION NO. 5: Any and all photographs of any asbestos-containing products manufactured, sold or distributed by Defendant or any subsidiary, predecessor or affiliated company, including such products that are packaged at the time the photograph was taken and products that were not packaged at the time the photograph was taken.

To the best of Capco's present knowledge, no such documents exist.

REQUEST FOR PRODUCTION NO. 6: A photograph or photocopy of any warning labels, if any, that were provided or placed on any asbestos-containing product or any packaging for any asbestos-containing product manufactured, sold and/or distributed by Defendant or any subsidiary, predecessor or affiliated company.

To the best of Capco's present knowledge, no such documents exist.

REQUEST FOR PRODUCTION NO. 7: Any and all documents reflecting profits made from the sale, distribution, or marketing of any products manufactured by the Defendant or a predecessor, subsidiary or affiliate company that contained any amount of asbestos or asbestos fibers.

Capco objects to this request on the grounds that it is unduly burdensome, overly broad and not calculated to lead to the discovery of relevant evidence.

REQUEST FOR PRODUCTION NO. 8: Any documents relating to the design, preparation, or introduction into the market or stream of commerce of any asbestos-containing products manufactured, sold, or distributed by the Defendant or any subsidiary, predecessor or affiliated company. These documents include, but are not limited to, written memoranda, specifications, recommendations, blueprints, and other written materials of any kind or character.

To the best of Capco's present knowledge, no such documents exist.

REQUEST FOR PRODUCTION NO. 9: Any and all documents reflecting or relating to testing, preparation for tests and/or the results of tests conducted to determine potential health hazards resulting from the use of materials, including but not limited to asbestos, contained in

asbestos-containing products before such products were first manufactured, marketed, sold, or distributed by the Defendant or any subsidiary, predecessor or affiliated company. This Request specifically includes, but is not limited to, any written memoranda, specifications, recommendations, blueprints, or other written materials of any kind or character related to the testing of any of Defendant's or any subsidiary's predecessor's or affiliated company's asbestos-containing products prior to their initial sale or distribution.

To the best of Capco's present knowledge, no such documents exist.

REQUEST FOR PRODUCTION NO. 10: Any and all documents related in any way to testing of Defendant's or any predecessor's subsidiary's or affiliated company's asbestos-containing products after the products had first been released, sold distributed, manufactured or marketed. This Request includes, but is not limited to, written memoranda, specifications, recommendations, blueprints, or other written materials of any kind or character relating to the potential health hazards of Defendant's or any of its predecessor's subsidiary's or affiliated company's asbestos-containing products or of the asbestos contained in such products.

To the best of Capco's present knowledge, no such documents exist.

REQUEST FOR PRODUCTION NO. 11: Any printed material, including brochures, pamphlets, catalogues, packaging or other written material of any kind or character containing any warnings concerning the possibility of injury resulting from the use of asbestos-containing products manufactured, sold, and/or distributed by the Defendant or any predecessor, subsidiary or affiliated company.

To the best of Capco's present knowledge, no such documents exist.

REQUEST FOR PRODUCTION NO. 12: Any and all written agreements, or documents reflecting or related to such agreements, for the distribution, marketing, manufacture, and/or sale of Defendant's asbestos-containing products by an entity other than Defendant or its subsidiaries, predecessors or related companies.

To the best of Capco's present knowledge, no such documents exist.

REQUEST FOR PRODUCTION NO. 13: Any documents, books, pamphlets, memoranda, articles or written materials of any kind or character that would indicate that asbestos fibers, when inhaled, can be hazardous to the health of human beings and that have been maintained in the possession of Defendant, or any subsidiary or affiliated company.

See documents produced.

REQUEST FOR PRODUCTION NO. 14: Any publications, minutes, circulars, magazines or reports, published, written or disseminated by any trade organization or association comprised of other manufacturers, miners, marketers, and/or sellers of products containing asbestos to which Defendant, any subsidiary, predecessor or affiliated company belonged at any time within the last fifty (50) years.

To the best of Capco's present knowledge, no such documents exist.

REQUEST FOR PRODUCTION NO. 15: Any and all documents reflecting any agreements, or stating any agreements to which Defendant or any subsidiary, predecessor, or affiliated company are a party to purchase asbestos or products containing asbestos from any other company or entity.

To the best of Capco's present knowledge, no such documents exist.

REQUEST FOR PRODUCTION NO. 16: Any printed sales materials prepared by Defendant or any of its subsidiary or predecessor companies or other agents for purposes of marketing, advertising and/or assisting sales of any products containing asbestos that were manufactured, sold or distributed by Defendant or any of its subsidiary, predecessor or affiliated companies.

See documents produced.

REQUEST FOR PRODUCTION NO. 17: Any and all written documentation relating to or stating the results of any studies or surveys including, incorporating or stating the proposition that asbestos products or products containing asbestos could be manufactured or designed so as to eliminate potential health hazards to persons working with or using them.

To the best of Capco's present knowledge, no such documents exist.

REQUEST FOR PRODUCTION NO. 18: Any and all documents reflecting or stating a "rebranding" agreement between Defendant or any of its subsidiaries, predecessors or affiliated companies and any other company at any time within the last fifty (50) years.

To the best of Capco's present knowledge, no such documents exist.

REQUEST FOR PRODUCTION NO. 19: Any and all documents reflecting workers' compensation claims or workers' compensation lawsuits brought against Defendant or any of its subsidiaries, predecessors or affiliated companies or any of the compensation carriers that allege that an individual contracted a disease from inhaling asbestos fibers or from inhaling unknown dust fibers.

To the best of Capco's present knowledge, no such documents exist.

REQUEST FOR PRODUCTION NO. 20: Any and all documents reflecting the minutes of corporate meetings of any kind or nature, whether of boards of directors, departments, or otherwise, which reflect or relate to asbestos, asbestos health hazards or asbestos products.

Capco objects to this request on the grounds that it is unduly burdensome, overly broad and not calculated to lead to the discovery of relevant evidence.

REQUEST FOR PRODUCTION NO. 21: Any and all invoices, shipping documents, bills of lading, purchase orders, or other documents of a similar nature relating to the mining, manufacture, marketing, sale, use, or distribution of asbestos or asbestos-containing products.

Capco objects to this request on the grounds that it is unduly burdensome, overly broad and not calculated to lead to the discovery of relevant evidence. Without waiving this objection, Capco is producing sales cards for sales to customers located in Texas during 1968, the only year that plaintiff Kiker alleges exposure to Capco pipe.

REQUEST FOR PRODUCTION NO. 22: Any and all documents reflecting the acquisition through purchase, reorganization, or merger of another company by Defendant that manufactured, sold, processed, distributed, or supplied asbestos or products containing asbestos at any time within the last forty (40) years.

To the best of Capco's present knowledge, no such documents exist.

REQUEST FOR PRODUCTION NO. 23: Any and all documents reflecting any studies, or the results of any studies, designed to assist in minimizing or eliminating the inhalation of asbestos dust and fibers by your workers and/or those of any subsidiary, predecessor, or affiliated company and/or those otherwise exposed to your company's asbestos-containing products.

To the best of Capco's present knowledge, no such documents exist.

REQUEST FOR PRODUCTION NO. 24: Any and all documents related in any way to the threshold limit values or maximum allowable concentrations of both asbestos dust and total dust provided by the American Conference of Governmental Industrial Hygienists.

See documents produced.

REQUEST FOR PRODUCTION NO. 25: Any and all documents reflecting or related to any tests, or the results of any tests, that Defendant or any of its subsidiaries, predecessors or affiliated companies ever made or completed, or had made or completed on its behalf, or reviewed, related to the quantity, quality, or threshold limit values, of asbestos dust or particles to which workers were exposed while using, working with or around, manufacturing or fabricating, or installing asbestos-containing products manufactured by Defendant or any of its subsidiaries, predecessors of affiliated companies.

To the best of Capco's present knowledge, no such documents exist.

REQUEST FOR PRODUCTION NO. 26: Any and all documents reflecting written guidelines or instructions or otherwise indicating in any way the purpose, nature and/or accomplishments of any research department established by Defendant or any of its subsidiaries, predecessors or affiliated companies, or any independent company that contracted with Defendant to provide research services, at any time within the last fifty (50) years.

To the best of Capco's present knowledge, no such documents exist.

REQUEST FOR PRODUCTION NO. 27: Any and all documents reflecting written guidelines or instructions or otherwise indicating in any way the purpose, nature, advice and/or accomplishments of any medical department established by Defendant or any of its subsidiaries, predecessors or affiliated companies, or any independent company that contracted with Defendant to provide medical services or advice, at any time within the last fifty (50) years.

To the best of Capco's present knowledge, no such documents exist.

REQUEST FOR PRODUCTION NO. 28: Any and all documents reflecting or related to the recall of any asbestos-containing products from the market or stream of commerce by Defendant or any of its subsidiaries, predecessors or affiliated companies or related to a decision by any of those entities to cease manufacturing, fabricating, selling, and/or distributing products containing asbestos.

To the best of Capco's present knowledge, no such documents exist.

REQUEST FOR PRODUCTION NO. 29: Any and all documents reflecting the physical or chemical composition, makeup or breakdown of any and all asbestos-containing products or components of products manufactured, sold, and/or distributed by the Defendant or any of its subsidiaries, predecessors or affiliated companies.

See documents produced.

REQUEST FOR PRODUCTION NO. 30: Any and all documents reflecting the films, disposition or settlement of any claims for workers' compensation benefits against Defendant or any of its subsidiaries, predecessors or affiliated companies, or the workers' compensation carriers of any and all of those entities that alleged an injury from inhalation of asbestos fibers or exposure to asbestos-containing products or dust of an unspecified origin.

To the best of Capco's present knowledge, no such documents exist.

REQUEST FOR PRODUCTION NO. 31: Any and all documents reflecting the receipt of raw asbestos, or the receipt of products containing asbestos, the date or dates they were received or shipped, the amounts received or shipped, or other information regarding shipment of raw asbestos or asbestos-containing products to or by Defendant or any of its subsidiaries, predecessors or affiliated companies.

See documents produced.

REQUEST FOR PRODUCTION NO. 32: Any and all documents related in any way to the discovery, initial comprehension, or first learning by Defendant or any of its subsidiaries, predecessors or affiliated companies that asbestos and exposure to asbestos fibers can cause asbestosis.

See documents produced.

REQUEST FOR PRODUCTION NO. 33: Any and all documents related in any way to the discovery, first learning, or initial comprehension by Defendant or any of its subsidiaries, predecessors or affiliated companies that asbestos and exposure to asbestos fibers can cause pleural thickening.

See documents produced.

REQUEST FOR PRODUCTION NO. 34: Any and all documents related in any way to the discovery, first learning, or initial comprehension by Defendant or any of its subsidiaries, predecessors or affiliated companies that asbestos and exposure to asbestos fibers can cause lung cancer.

See documents produced.

REQUEST FOR PRODUCTION NO. 35: Any and all documents related in any way to the discovery, first learning, or initial comprehension by Defendant or any of its subsidiaries,

predecessors or affiliated companies that asbestos and exposure to asbestos fibers can cause types of cancer other than lung cancer.

See documents produced.

REQUEST FOR PRODUCTION NO. 36: Any and all documents related in any way to the discovery, first learning, or initial comprehension by Defendant or any of its subsidiaries, predecessors or affiliated companies that asbestos and exposure to asbestos fibers can cause mesothelioma.

See documents produced.

REQUEST FOR PRODUCTION NO. 37: Any and all documents reflecting or related to Defendant's or any of subsidiary's, predecessor's or affiliated company's policies concerning employee safety and the avoidance of accidents, including, but not limited to safety brochures, guidelines, bulletins, publications, safety meeting minutes, and/or safety guidelines.

See documents produced.

REQUEST FOR PRODUCTION NO. 38: Any documents related to work accidents sustained by any of Defendant's or any of its subsidiary's, predecessor's or affiliated company's employees involving the inhalation of fumes, gases or dusts and safety guidelines related to such inhalation, including but not limited to all accident reports or other written materials related in any way to injuries resulting from such inhalations.

To the best of Capco's present knowledge, no such documents exist.

REQUEST FOR PRODUCTION NO. 39: Any documents reflecting or related to Defendant's or any of its subsidiary's, predecessor's or affiliated company's right to contractual indemnity or indemnification from any person, corporation, or business entity for any damages, or potential damages, sustained or that could be sustained, or lawsuits that might or could be filed as the result of the manufacture, sale and distribution of any products containing asbestos by Defendant or any of its subsidiaries, predecessors or affiliated companies.

To the best of Capco's present knowledge, no such documents exist.

REQUEST FOR PRODUCTION NO. 40: Any chart of an organizational nature demonstrating Defendant's relationship with its subsidiaries (both foreign and domestic), predecessors, and any other related companies or entities from 1930 to the present.

To the best of Capco's present knowledge, no such documents exist.

REQUEST FOR PRODUCTION NO. 41: Any documents reflecting or related to Defendant's mix sheets for any products manufactured by Defendant's or Defendant's subsidiaries, predecessors or affiliated companies.

To the best of Capco's present knowledge, no such documents exist.

REQUEST FOR PRODUCTION NO. 42: Any Material Data Safety Sheets (MDS) pertaining any asbestos containing products manufactured and/or distributed by Defendant or any of its subsidiaries, predecessors or affiliate companies.

To the best of Capco's present knowledge, no such documents exist.

CERTIFICATE OF SERVICE

The undersigned certifies that a true and correct copy of the foregoing instrument has been served on Allen Vaught, Baron & Budd, P.C. by Federal Express on the 24th day of August, 2001.

PORZIO, BROMBERG & NEWMAN, P.C.
Attorneys for Defendant,
Capco Pipe Company, Inc.

By: _____
Kenneth R. Meyer, Esq.

Dated: August 24, 2001

JOHNS-MANVILLE SALES CORPORATION
Pipe Division
22 East 40th Street
New York, New York 10016

December 26, 1967

Mr. Ed Koch
Orangeburg Mfg. Co.
Highview Avenue
Orangeburg, N. Y. 10962

Mr. James Reichel
Certainteed Products Corp.
Pipe Division, Lea Bldg.
Ambler, Pa. 19002

Mr. Lee Taylor
Cement Asbestos Pipe Co.
Bessemer, Alabama

Gentlemen:

We believe we can save some valuable time at our forthcoming January 3rd meeting, by sending you some information, which you can read before hand. Accordingly, there are the following attachments:

1. The original article in the newspaper from Nashville, which represents the first known concern regarding a possible health hazard in the use of asbestos-cement pipe.

2. Later articles in the Nashville paper that were printed after several of the councilmen visited Johns-Manville Research Center, and were also talked to by Dr. George Wright.

3. A copy of a report by W. C. Euper, entitled "Occupational and Environmental Cancers of the Respitory System", which also outlines many of the other known or suspected carcinogenic materials.

continued. . . . . .

4. A letter to Johns-Manville from Mr. McCabe of the U. S. Public Health Service.

5. A paper presented in England making a positive statement that there is no danger from cancer from the use of asbestos-cement pipes.

6. A copy of a letter to us from Hill and Knowlten, outlining some statistics on the mortality from stomach cancer in the United States.

It may be that you have had access or have read several of these attachments before. Our purpose in sending them all, is to provide you some of the general background information on this subject so that it need not be repeated at our January 3rd meeting.

We have also recently learned of three other areas where this question has been posed since the original Nashville article.

1. Officials of Fairfax County, Virginia showed our representatives a copy of the original Nashville article. Our customers inferred that this Nashville article was given to them by a cast iron competitor.

2. The Water Superintendent of the City of Jackson, Mississippi intended to pose this same question before the council at their regular meeting in December. This was postponed.

3. Dr. A. L. Gray, Director of the State Health Department of the State of Mississippi, has corresponded with the Department of Health, Education and Welfare concerning this general subject.

So much for the history and background of what has finally led up to our meeting of January 3rd. We will try to accomplish the following at this coming meeting.

Dr. George Wright, a leading medical researcher in the field of asbestos related environmental health problems---who is the Director of Research at St. Luke's Hospital in Cleveland, Ohio--- will speak to us about the entire field of asbestos as a possible health hazard.

With this background, we could then like to cover with you some of the research in this area that our Company now has under way, and the possible need for additional and different types of studies

continued. . . . .

td be made. Then from these discussions, we need to further develop what data or material should be placed in the hands of our field representatives, in order for them to intelligently answer customers' questions concerning the various health aspects.

We have also invited Mr. Eric Johnson, Secretary of the American Water Works Association, to our entire meeting.

You are also invited to bring your respective legal counsels to the entire meeting, since ours will be in attendance.

Very truly yours,

Monroe Harris

Monroe Harris, Vice-President & General Marketing Manager

MH/jc
atts.

THE NASHVILLE TENNESSEAN

SILLIMAN EVANS SR. (Publisher, 1937-1953) SILLIMAN EVANS JR. (Publisher, 1953-1981)

AMON C. EVANS, Executive Vice President and Publisher

JOHN SEIGENTHALER, Editor LLOYD ARMOUR, Associate Editor

The news columns shall be fair and accurate and the editorial columns shall be honest and just in the expression of conscientious opinion.—Silliman Evans Sr.

People Can Find Fault

MR. ROBERT L. LAWRENCE Jr., Metro waterworks director, says he can "find no fault" with purchasing practices which have permitted one company to supply practically all of Metro's iron water pipe for the past five years.

Perhaps Mr. Lawrence has not looked for enough for the fault. But the people find it strange, to say the least, that James B. Clow & Sons Co. consistently turn in low bids on iron pipe in Nashville, while the firm is almost always underbid on the same pipe in Chattanooga and Memphis.

The business of Chattanooga and Memphis usually goes to U.S. Pipe and Foundry Co., while Clow consistently is successful bidder for pipe sales to Metro and Knoxville.

"If there's any collusion," Mr. Lawrence told Metro Council's purchasing committee, "then it's something for the federal government to look into. They have a responsibility in this area."

Mr. Lawrence is right about that. The Justice Department should look into the matter, and Councilman Frank Griffin suggested that the committee should go to the district attorney.

But this does not relieve the waterworks department of the responsibility to see that the taxpayers are not being cheated on the purchase of iron pipe. Mr. Lawrence is not doing enough just to sit back and open the bids without trying to find out why Clow is always low bidder in Nashville and U.S. Pipe and Foundry is low in Memphis and Chattanooga. In addition, Council has a responsibility to make sure that competitive bidding is a part of the government's purchasing and contract procedures and policies.

Mr. Lawrence showed the committee a tabulation of comparative costs of water pipe to Metro and six other cities. The tabulation showed that Metro was paying more for the pipe in 19 out of 20 instances, but Mr. Lawrence said this was because his department purchases "superior pipe."

The question is whether some other "superior pipe" isn't cheaper.

Other cities seem to get by all right on what Mr. Lawrence probably would call "inferior" materials. They get their pipe at a lower price than that paid by Metro.

The purchasing committee should demand that the waterworks department not rely entirely on the district attorney and use initiative o[illegible]own to find out why one fi[illegible]

CAPCO KIN 0000065

Lawrence Raps Pipe Proposals

By DICK BATTLE

Robert L. Lawrence Jr., Metro director of water and sewerage services, said today in this opinion "there is no comparison between asbestos-cement pipe and cast iron pipe."

Nationally recognized as one of the country's outstanding water system authorities, Lawrence blasted proposals by Councilman James LaPenna to change pipe specifications to allow asbestos-cement pipe manufacturers to bid against cast iron pipe producers to force lower bids on iron pipe.

LaPenna was quoted as stating following Tuesday night's council session that he was "not suggesting that Metro switch to the asbestos-cement" but should merely rewrite specifications to

(Please Turn to Page 6, Col. 6)

Lawrence

(Continued From First Page)

allow the asbestos-cement people to bid.

Not Comparable

Lawrence said "asbestos-cement pipe is obviously not comparable to cast iron, particularly for use in our rocky soil. Its strength is much less than cast iron and it would be a disservice to the people of this community to substitute this material for cast iron.

"Based on my own experience and knowledge and the experience and research of some outstanding engineering consultants, I will not recommend the use of this (asbestos-cement) pipe in our system. I am not going to recommend what I consider to be an inferior material for use in our system."

The director scored LaPenna's proposal to change specifications to open up bidding to asbestos-cement pipe with no intention of purchasing such pipe if it came in on the low bid. "It's not honest as far as I'm concerned," Lawrence said.

Dishonest

"I won't recommend changing specifications to allow bids to be submitted for asbestos-cement pipe when I cannot conscientiously recommend purchase of this pipe if it comes in on the low bid. As far as I'm concerned that would be dishonest. It would also be unfair to the asbestos-cement people who might submit bids, to use them simply to force better prices on cast iron pipe when we have no intention of changing the system to asbestos-cement pipe."

LaPenna, chairman of the council's new "watchdog" purchasing committee, offered the scheme for pushing down bids on cast iron pipe. He also gave every councilman and members of the press a letter he had solicited from an asbestos-cement pipe manufacturer which cited possibility of $77,630 "savings" if Metro shifted from cast iron to asbestos-cement pipe next year.

Savings Offset

Lawrence said the asbestos-cement pipe required "great care" in laying. "The additional cost of laying this kind of pipe would, in my opinion, offset any saving that might accrue from the difference in the cost of the pipe."

LaPenna said the pipe manufacturer with whom he was in correspondence had offered an "all expense paid trip" to the firm's New Jersey plant for members of the council purchasing committee, Lawrence and members of his staff, newsmen and any "other interested individuals".

In answer to questions from the floor, LaPenna said the pipe manufacturing firm's offer "means they'll pick up the tab for everything. I didn't ask what 'everything' means, but I suppose it means EVERYTHING."

His statement was greeted with laughter but there were no immediate "takers."

CAPCO KIN 0000066

NASHVILLE TENNESSEAN

DECEMBER 12, 1967

Asbestos Pipe, Cancer Tie Hit

By JIM SQUIRES
Staff Correspondent

NEW YORK -- There is no evidence to support a recent statement by a Nashville doctor that use of asbestos—cement water pipe might cause cancer, a noted cancer researcher said here yesterday.

Dr. George Wright, chairman of The Institute for Occupational and Environmental Health, said he did not think such a relationship "will ever be established."

WRIGHT, HEAD of the department of medical research in internal medicine at St. Luke's Hospital in Cleveland, Ohio, said a letter from Dr. James Snell, an assistant professor at Vanderbilt University school of medicine, suggesting such a relationship "apparently arises out of an incomplete perspective" of the problem.

Wright spoke to nine Metro councilmen here to tour a Johns-Manville plant in Newark, N.J., a manufacturer of asbestos-cement pipe.

Snell sent a letter last month to Metro waterworks director Robert L. Lawrence supporting Lawrence's decision to prohibit asbestos-ce-

(Turn to Page 12, Column 1)

Asbestos Pipe, Cancer Tie Hit

(Continued From Page One)

ment manufacturers from bidding on Metro waterpipe purchases.

The council committee on purchasing had suggested that Lawrence allow asbestos-cement manufacturers to bid because the product is less expensive than the cast iron pipe now being used.

SNELL WROTE that asbestos is a known cause of cancer and can contaminate drinking water. The physician said he did not believe this fact had been brought to the attention of the U.S. Public Health Service.

Wright, an adviser to the U.S. Public Health Service, said the asbestos-cement pipe industry had long been aware of a link between certain types of asbestos fibers and lung cancer and with Mesothelioma, a rare malignant tumor found on the lung covering and the gastrointestinal tract.

He pointed out, however, that asbestosis (a lung tissue disease) and lung cancer are caused only by inhalation of certain asbestos fibers in large amounts and over long periods of time.

MESOTHELIOMA, he said, has never been linked positively with swallowed amounts of asbestos and is "extremely rare."

"Evidence of research indicates that virtually everyone is exposed to asbestos fibers," he said. "In fact, it would appear reasonable to assume that there is no such thing as not having been exposed. If mere exposure is a cause, we would all have it."

Wright cited widespread use of asbestos fibers in insulation, electrical wiring and stove-eyes and toasters.

"THERE IS A great upswing in the use of asbestos fiber, but the incidence of cancer has actually fallen off," Wright said.

Wright said asbestos-cement pipe, consisting of 20% asbestos fiber, has been in water systems in some areas for as long as 70 years. In many instances, he said, there is no evidence of wear in these pipes to release asbestos fiber.

"After this many years of experience, if these fibers were to be a source of Mesothelioma — a dramatic tumor — it would be known," Wright stated.

"THIS WOULD not escape. This is not a new point of interest to the industry," he added.

Wright said manufacturers of asbestos products were among the first to discover its possible biological effects and have spent "millions of dollars" in the field.

The doctor said he is preparing a written answer to Snell's statement.

"I don't know Snell or his background in this area," Wright said, "but no doctor is knowledgeable in all areas. I have spent much of my life in this field, and even I am not."

SNELL WROTE Lawrence Nov. 14, stating he would consider the use of asbestos-cement pipe "a medical hazard of significant degree" until the U.S. Public Health Service had checked it out completely.

Officials of the Johns-Manville Co., asked about this yesterday, said the Public Health Service is among its customers.

"We have sold them thousands of feet of pipe," said Jay Baker, product manager. "I feel certain we will sell them much more."

THE COUNCILMEN are scheduled to tour the manufacturing plant and research center today. The company claims its product will save Metro $200,000 a year on pipe purchases.

CAPCO KIN 0000067

Early December, 1967

Council Invited To N.Y. Pipe Study

Members of the Metropolitan Council have been invited to go to New York next month to study the possibility of using asbestos cement pipe for Metro's water system, it was announced yesterday.

Councilman James J. LaPenna, chairman of the council's special "watchdog" committee for government purchases, said the invitation had been extended by the Johns-Manville Co. which maintains a research center just outside New York.

LaPenna's committee voted to take the trip to determine if the pipe would be feasible for use here.

"THIS WILL be a work trip and it will not be an entertainment one," LaPenna told the council. He said it had been estimated Metro would save $250,000 a year by using the pipe instead of cast iron pipe.

For the past 4½ years Metro has bought all its cast iron pipe from a single concern—Clow and Sons — which has consistently submitted the low bid.

LaPenna said all members of the council as well as representatives of the mayor's office and the waterworks department were invited to make the trip Dec. 11-12. Johns-Manville, which manufactures the pipe, will fly the councilmen to and from New York in a company-owned airplane.

COUNCILMAN Richard Taylor attacked the invitation on the council floor, saying, "This is ridiculous . . . this is setting a horrible precedent to offer to take the whole council and the press and television to New York."

He said his committee had considered the pipe and had recommended Metro continue to use cast iron pipe. Taylor said it might be proper for LaPenna to make the trip, but not a large group.

"Why do they want to take you all if they don't expect something in return?" he asked.

COUNCILMAN Sanders Anglea said he felt council members should see the product for themselves.

"We're down here criticizing this product when we don't know anything about it. Those who have been criticizing it ought to go up there and see if what they have had to say is correct," he said.

Councilman Frank Griffin said he agreed with Anglea, adding, "I read about department heads being in Hawaii, in Dallas, in Washington, just about everywhere. But when it comes time for a councilman to go anywhere, there is no money available.

Councilman Mansfield Douglas III said he felt as many councilmen as possible should accept the company's offer.

CAPCO KIN 0000068

12/11/67

Councilmen To Go On Pipe Plant Tour

By JIM SQUIRES

Nine Metro councilmen will leave today for a two-day inspection tour of the Newark, N.J., plant of the Johns-Manville Co., a manufacturer of asbestos-cement water pipe.

The pipe firm has invited the lawmakers in an effort to convince them that the cheaper asbestos-cement product is an adequate substitute for the costly cast iron now being used in Metro's water system.

THE COMPANY claims Metro can save $200,000 annually by buying asbestos-cement pipe.

Robert L. Lawrence, Metro waterworks director, has consistently refused to allow asbestos-cement pipe companies to bid on government purchases. He declined the invitation to tour the plant.

Making the trip are Councilmen James LaPenna, Frank Griffin, Earl Shacklett, Mansfield Douglas, Martin Garrett, Thomas Sharp, John Fox, Robert McBride and John Driver.

LaPenna is chairman of the council's "watchdog" committee on purchasing which is now investigating Metro's pipe purchases.

THE COMMITTEE was formed and the probe launched following an investigation by THE NASHVILLE TENNESSEAN which disclosed that one cast iron pipe company, James B. Clow & Sons, has won every Metro pipe contract in the last four years.

Through a hodge-podge pattern of bidding, the investigation disclosed, Clow has gotten all Metro pipe business, while its two major competitors have been equally successful in Chattanooga and Memphis and in small towns surrounding Nashville.

Clow has been the low bidder in Nashville on every contract, while at the same time bidding high on similar pipe in other areas of the state. At the same time, companies bidding high in Nashville consistently underbid Clow in towns as close as Murfreesboro and Columbia.

LaPenna has proposed widening specifications to allow competition between cast iron and asbestos-cement manufacturers.

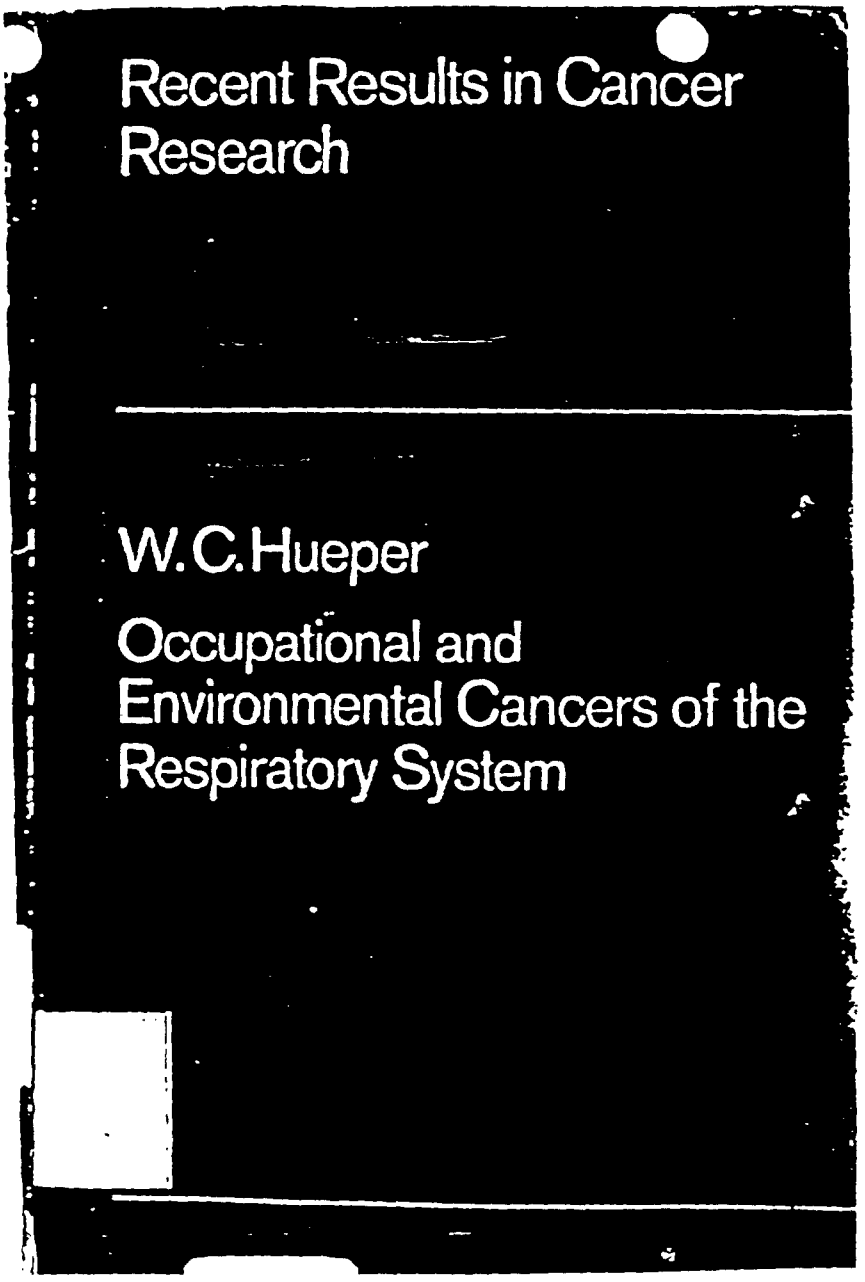
Lawrence has refused to do this, saying he has no intention of accepting an asbestos-cement company bid no matter how low the price.

AT THE LAST council session, he distributed a pamphlet which claimed to show the superior strength of castiron compared with asbestos-cement.

The pamphlet was prepared by the Cast Iron Pipe Research Association.

The councilmen will return to Nashville tomorrow night.

CAPCO KIN 0000069



CAPCO KIN 0000070

Recent Results in Cancer Research

Fortschritte der Krebsforschung

Progrès dans les recherches sur le cancer

3

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Occupational and Environmental Cancers of the Respiratory System

W. C. Hueper

With 48 Figures

Springer-Verlag · New York, Inc. 1966

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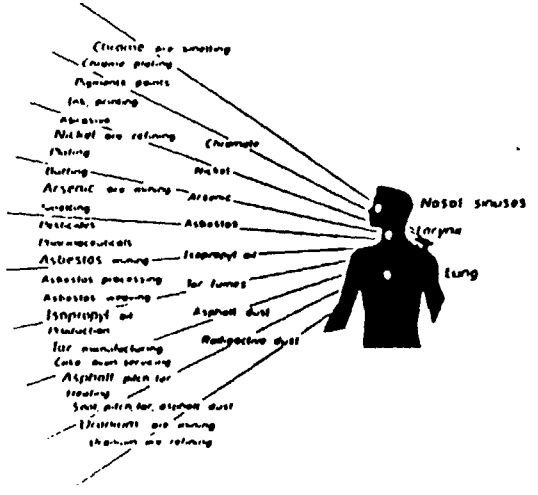
Introduction

Since the advent of the modern industrial era some 150 years ago, a large and growing number of diverse man-made chemicals have been introduced in increasing amounts into the occupational and general environmental air. This development of industrial atmospheric pollution, while first rather mild and locally restricted, has assumed during recent decades with the growing industrialization of the human economy, regional proportions which encompass in some cases large portions of entire States and countries covering them especially in their metropolitan areas, with an almost permanent cloud of chemical effluents. Many of these chemical wastes contaminating the environmental air of industrial establishments and communities and composed of constantly changing mixtures of identified and non-identified chemicals are to varying degrees, irritants to the respiratory mucosa in which they elicit by chemical action or by mechanical trauma, a variety of functional and anatomic disease manifestations (chronic laryngitis, tracheitis and bronchitis, emphysema, chemical pneumonitis, bronchiectases, pneumoconiosis).



CAPCO KIN 0000073

With the rapid rise in the frequency of lung cancers in all industrialized countries observed since the turn of the century, this progressive industry related contamination of the atmosphere with a great variety of dusts, fumes, mists, vapors, and gases has become the subject of increasing interest as one of the causes underlying the recent developments in the respiratory cancer panorama. Diverse chemical atmospheric pollutants of industrial origin have been incriminated as specific and nonspecific respiratory carcinogenic irritants.

Table of Contents

A. Nonspecific Industrial Irritants 1

Pneumoconiosis 2

a) Mineral Dust Pneumoconiosis 2

α) Anthracosis 2

β) Silicosis 2

b) Vegetable and Animal Dust Pneumoconiosis 6

α) Tabacosis 6

β) Shellac Pneumoconiosis 7

c) Chronic Chemical Pneumonitis and Bronchitis 7

B. Specific Industrial Respiratory Carcinogens 7

1. Significance of Specific Industrial Carcinogenic Irritants 8

a) Classification of Occupational Respiratory Carcinogens 9

b) Route of Exposure 11

2. Occupational Respiratory Cancer and Smoking 13

3. Epidemiology of Occupational Respiratory Cancers 15

4. Pluripotentiality of Respiratory Carcinogens 21

5. Carcinogenic Symptom Complex 21

6. Sex distribution 22

7. Occupational „Neighborhood" Cancers 23

8. General Peripheral Dissemination 23

9. Carcinogenic Potency and Attack Rates of Industrial Respiratory Cancers . . 24

10. Age Distribution 24

11. Latent Period 27

12. Histologic Types 28

C. Specific Occupational Cancers and Their Environmental Counterparts 28

1. Arsenic 30

a) Non-occupational Sources of Exposure to Arsenicals 31

α) Atmospheric Urban Pollutants 31

β) Water Pollutants 31

γ) Foodstuff Contaminants 31

δ) Soil Contaminants 32

ε) Tobacco Contaminants 32

b) Arsenicals as Carcinogens 32

c) Respiratory Arsenic Cancers 33

d) Experimental Arsenic Cancer 38

CAPCO KIN 0000074

2. Asbestos . . . 38
a) Technologic Data . . . 38
b) Epidemiologic Data on Asbestos and Carcinoma of the Lung . . . 41
c) Clinicopathologic Relations . . . 47
d) Epidemiologic Data on Mesotheliomas of the Pleura and Peritoneum . . . 50
e) Age Distribution of Asbestosis Cancers . . . 52
f) Sex Distribution of Asbestosis Carcinomas of the Lung . . . 53
g) Anticarcinogenic Action of Asbestos . . . 53
h) Syncarcinogenesis in the Production of Asbestosis Cancers . . . 54
i) Exposure Time and Latent Period . . . 54
k) Experimental Production of Cancers with Asbestos . . . 54
l) Causative Mechanism of Asbestos Carcinogenesis . . . 55

3. Chromium . . . 56
a) Technologic Aspects . . . 57
b) Epidemiologic Cancer Aspects . . . 59
c) Special Aspects . . . 64
d) Histologic Types of Chrome Cancers of the Lung . . . 65
e) Clinical Aspects . . . 70
f) Chromium Content of Tissues, Blood and Urine . . . 70
g) Atmospheric Neighborhood Pollution . . . 72
h) Atmospheric Intraplant Pollution . . . 75
i) Chromate Carcinogenesis and Smoking Habit . . . 75
k) Experimental Production of Chrome Cancers . . . 76
l) Causative Mechanism of Chromium Carcinogenesis . . . 80
m) Preventive Measures . . . 82
α) Technologic Measures . . . 83
β) Medical Prophylactic Measures . . . 84

4. Nickel . . . 85
a) Technological Aspects . . . 85
b) Epidemiology . . . 86
c) Pathology . . . 89
d) Etiology . . . 89
e) Experimental Production of Nickel Cancers . . . 91
f) Carcinogenic Mechanism . . . 93
g) Prophylaxis of Nickel Cancer Induction . . . 93

5. Iron . . . 93
a) Technological Aspects . . . 93
b) Epidemiology . . . 94
c) Experimental Iron Carcinogenesis . . . 97
d) Etiology . . . 98

6. Beryllium . . . 99
a) Technological Aspects . . . 99
b) Epidemiology . . . 99
c) Beryllium Cancers . . . 101
d) Etiology . . . 102

7 Mustard Gas — Yperite Lost — Beta, beta'-dichlorodiethyl sulfide — Bis(beta-chloroethyl) sulfide . . . 103
a) Technological Aspects . . . 103
b) Epidemiology . . . 103
c) Experimental Mustard Cancers . . . 105
d) Etiology . . . 105

8 Isopropyl Oil . . . 105
a) Technological Aspects . . . 105
b) Epidemiology . . . 106

9 Coal Tar, Tar Oils, Soot, and Other Combustion Products of Coal . . . 107
a) Technological Aspects . . . 107
b) Epidemiology . . . 108
c) Experimental Respiratory Carcinogenesis . . . 114

10 Petroleum — Mineral Oil — Wax — Asphalt — Petroleum Carbon — Carbon Black — Methylated Naphthalene — Combustion Products — Shale Oil and Derivates . . . 118
a) Technological Aspects . . . 118
b) Epidemiology . . . 120

11. Ionizing Radiations . . . 125
a) Technological Aspects . . . 125
b) Epidemiology . . . 126
α) Respiratory Cancers in Radioactive Ore Miners and Millers . . . 127
αα) Radioactive, Non-Uranium Miners . . . 127
αβ) Lung Cancer in Schneeberg Miners . . . 127
αγ) Radioactive Lung Cancer Hazard in a Fluorspar Mining Community in Newfoundland . . . 131
αδ) Miscellaneous Non-Uranium Mines . . . 133
β) Uranium Ore Miners . . . 136
βα) Lung Cancer in Joachimsthal Miners . . . 136
ββ) Lung Cancers in Uranium Ore Miners of the Colorado Plateau . . . 138
γ) Lung Cancer Hazards for Employees of Uranium Ore Refineries, Radium Laboratories, Nuclear Installations and Power Plants and Similar Establishments . . . 142

12. Miscellaneous Respiratory Carcinogens . . . 147
a) Isonicotinic Acid Hydrazide (Isoniacid) . . . 148
b) Nitrosamines . . . 149
c) Nitroquinolines and Related Nitro- and Amino-Compounds . . . 150
d) Carbamates . . . 151
e) Chlorinated Hydrocarbons . . . 151
f) Formaldehyde . . . 152
g) Natural and Man-Made Polymers . . . 152

D Prevention and Control of Occupational Respiratory Cancer Hazards . . . 153

References . . . 155

Subject Index . . . 208

CAPCO KIN 0000075

A. Nonspecific Industrial Irritants

The "chronic irritation theory" of cancerigenesis proposed by Virchow around the middle of the past century forms the scientific basis for the often-repeated claim that the inhalation of nonspecific irritative air pollutants, especially those encountered in certain industries and occupations, represents a significant cause of cancers of the respiratory system.

In support of such allegations, it is argued that any air pollutant (dust, fume, mist, vapor, gas) exerting a prolonged but nonspecific irritating effect upon the respiratory mucosa would stimulate in this tissue epithelial proliferations and metaplasias which ultimately would lead to cancerous developments (SCHMORL; HAMPERL; SEYFARTH; DUGUID; BROCKBANK; KREYBERG; STAEMMLER) and that, therefore, people employed in "dusty" work were more liable to develop lung cancers than people with "open-air" occupations and "housework" (KREYBERG). *In agreement with such statements are the observations that there seems to exist,* according to statistical studies, a positive association between previous respiratory diseases of chemical or parasitic nature (chronic bronchitis, chronic fibrosing pneumonia, bronchiectasis, tuberculosis, influenza, etc.) and the subsequent appearance of lung cancers (ROSSEL; WOODRUFF and NAHAS; FINKE; CASE and LEA; CAMPBELL and LEE; CUNNINGHAM; NASSAU and WALTER).

In fact, chronic inflammatory processes in this organ system, especially chronic bronchitis, regardless of their infectious or chemical etiology, have been proposed as furnishing the principal basis for subsequent cancerous developments in the lung (PASSEY; LOHR and WAGNER). The existence of such correlations has been advocated particularly in England, where industrial air pollution, chronic bronchitis and cancer of the lung are most prevalent (NATIONAL SURVEY; STOCKS; PEMBERTON FAIRBAIRN and REID; BURGESS and SHADDICK; CAMPBELL and LEE; KUSCHNER), although BRETT *recently was unable to demonstrate any statistically significant* associations between lung cancer and previous respiratory disease. A similar connotation regarding the existence of interrelations between chronic fibrosing processes of the lung, regenerative bronchiolar epithelial proliferations in their periphery and the subsequent development of pulmonary cancers from such lesions is incorporated in the concept of scar cancers of the lung proposed by RÖSSLE; FRIEDRICH; LÜDERS and THEMEL; and others. BALO, JUHASZ and TEMES suggested that a part of the recent increase in lung cancer might be attributable to the formation of lung cancers around pulmonary infarcts, since there has been a rise in embolic processes during recent years due to the increase in cardiovascular diseases. Since STANTON and BLACKWELL failed to induce experimentally cancers of the lung near infarcted areas unless a specific carcinogenic chemical was also administered, it is unlikely that scar formation as such predisposes to the development of lung cancers and that for this reason the

CAPCO KIN 0000076

concept of traumatic cancers of the lung has any scientific and medicolegal validity (Hueper). This interpretation of the available evidence is supported by the following specific observations.

Pneumoconiosis

Chronic fibrosing processes in the lungs of benign or progressive character are often the result of an occupational inhalation of foreign materials in the form of particles or droplets, which are in part retained in the lung (Stoeber). While some investigators have claimed that such exposures and their anatomic sequelae might ultimately lead to the development of pulmonary cancers, this concept is not supported by the majority of the epidemiologic facts on hand for most of these conditions (anthracosis, aluminosis, siliicosis, barytosis, retinosis, tuberosis, hystinosis, etc.) (Teleky; Koelsch; Hueper). There is so far only a single case on record in which a cancer of the lung developed in a worker who had suffered from bagassosis (Onuigbo). The most comprehensive and convincing data on the absence of such associations exist for the two most common pneumoconiosis, namely, anthracosis and silicosis.

a) Mineral Dust Pneumoconiosis

α) Anthracosis

Various epidemiologic studies of the frequency of lung cancers among coal miners often affected with anthracosis which were conducted in several countries have shown that members of this population group have not an excessive liability to this type of cancer, and that in fact their lung cancer mortality rate, as a rule, is lower than the standard rate for the entire population and is similar to that of the rural population, which generally is the lowest of all occupational and socio-economic groups investigated (Kennaway and Kennaway; James; Dyer; Feil; Versluys; Gerbis; Schulz; Allen; Schulte). The bronchitis rate for coal miners, on the other hand, was found to be highly excessive (Stocks). Anthracosis which is a nonprogressive type of pneumoconiosis, therefore, does not exert any demonstrable favorable influence on the induction of pulmonary cancer.

β) Silicosis

Silicosis has been in the past and to somewhat lesser extent still is a rather common occupational disease occurring among members of several large worker groups, such as especially hard rock miners, foundry workers, anthracite miners, stone masons and granite cutters. The relationship of silicosis to cancer of the lung covers three aspects (Hueper; Weissman).

A. The occurrence of large densities observed on x-ray film of the chest in individuals suffering from tuberculosilicosis may be mistaken for carcinoma of the lung.

B. It has remained controversial whether silicosis favors the development of lung cancer, hinders it, or does not exert any influence on this process.

C. Since the exposure to several established or suspected occupational respiratory carcinogens (radioactive substances, iron, arsenic) is complicated in some occupations by a simultaneous contact with silica, the role of silica and silicosis on the action of the specific carcinogens and on the cancerization process, respectively, has remained a subject of dispute.

The difficulties not infrequently encountered in the clinical diagnosis of cancer of the lung, whenever chronic inflammatory conditions prevail in this organ, are common experience and are likely to be aggravated in the presence of a tuberculosilicosis (Kerrigan; Schautz and Klein; Bradshaw and Chodoff). A definite diagnostic decision in some such cases may be possible only through an autopsy. The degree of diagnostic uncertainty which may be created under in vivo conditions may be judged by the fact that the diagnosis of cancer of the lung was found either to be incorrect or not justified by the clinical evidence presented in approximately 40% of several hundred cases in which cancer of the lung was listed on the death certificate as the cause of death. Epidemiologic studies on the association of silicosis and carcinoma of the lung based solely on clinical criteria have evidently only limited scientific value and may even yield misleading information.

Under the influence of the theory incriminating chronic irritation as a major cause of cancer through stimulating a typical regenerative cell proliferation, silicosis was considered by various investigators as a condition favoring through mechanical, physical or chemical irritation, the development of lung cancer (Adamo; Morel *et al.*; Piazza; Grosse; Eberhardt; Bossi; Tareda *et al.*; Ahlendorf; Astorri; Fiat and Jaso; Dible; Anderson and Dible; Klotz and Simpson; Racugno and Carta; Schautz and Klein; Chiurco; Dersitein; Puccini; Ghislandi and Finulli; Klotz; Kikuchi and Kodama). In support of this claim, Schautz and Klein as well as Puccini and Dersitein, cited the occurrence of epithelial metaplasias in the bronchial mucosa of individuals with silicosis coexisting with bronchogenic carcinoma. They asserted that the development of such precancerous changes in the bronchial mucosa were stimulated by the chronic bronchitis which according to these authors is regularly associated with even minor silicotic pulmonary changes. Pahl, on the other hand, noted a very low incidence of chronic bronchitis (0.1%) in Rhodesian copper miners among whom silicosis is prevalent. A similar connotation has the observation of Chatgimaris who reported that the enlarged bronchial glands with excessive mucous secretion and dilated ducts found among white South African gold miners with silicosis was a phenomenon commonly seen also among elderly male non-miners. These lesions, therefore, were regarded by him as causally not related to the silicotic state.

In contrast to Kaiilau, who contended that only minor silicotic lesions furnish a favorable soil for subsequent cancerous developments, Schautz and Klein claimed that the close topographic relation between fibrotic silicotic scarred areas in the lung and carcinomas of this organ indicated the existence of positive associations between the two conditions. This concept of silicosis carcinoma of the lung proposed in recent years again by Roessle and Raio, is closely related to the concept of cancer of the lung forming in the marginal areas of old tuberculous and syphilitic scars and of infarcts.

It is possible that pulmonary scars with their locally disrupted vascular supply and their phagocytic accumulations may indeed favor the development of cancers from the surrounding tissue because of their tendency to arrest and store foreign matter which is either inhaled or after ingestion or parenteral introduction has entered the circulating blood (Hueper). Since such substances retained in and around

CAPCO KIN 0000077

pulmonary scars may possess carcinogenic properties, such as tar, the occurrence of cancerous reactions near fibrous silicotic nodules is conceivable provided that an associated exposure to some specific carcinogen takes place (Ragaigne and Carea). The carcinogenic effect under such circumstances would not depend upon any non-specific irritative action of silica or be the result of some mysterious aberration of regenerative cellular proliferations but would be the result of some secondary and independent carcinogenic exposure for which the silicotic scar tissue acts in the role of a localizing and preparatory focus.

The bulk of the available epidemiologic evidence on the association of silicosis and lung cancer supports the view of a mere coincidental role of silicosis in this combination. Several large statistical analyses performed on autopsy material derived from several occupational groups with silicosis hazard confirm this conclusion (Table 1), which is, moreover, shared by many experienced investigators (Vorwald

Table 1. *Frequency of Carcinoma in Lungs with Silicosis*

Author	No. of Silicotic Lungs at Autopsy	No. of Carcinomas of Lung in Series	Percentage of Lung Cancers
Klotz, 1932	50	4	8.00
Golding, 1946	270	—	0.70
	170	3	
Spoerlein, 1952	81	1	1.70
	383	7	1.80
Fine and Jaso, 1938	22	1	4.54
Meiklejohn, 1950	210	4	1.90
Fruehling *et al.*, 1953	186	10	5.37
Leicher, 1948	256	12	4.68
Sladden, 1933	60	2	3.33
Ruettner, 1949	2204	32	1.50
Sweany *et al.*, 1936	40	1	2.50
Eisenhardt, 1949	804	4	0.50
Lavenne	358	7	1.95
Vorwald and Kuhn, 1935	1438	10	0.75
Mittmann, 1959	5951	440	8.00
Becker, 1958	439	13	3.00
Total	12,922	551	3.11

and Kabe; Schulz; Schulte; Kennaway and Kennaway; Meriwether; Faulds; Mittmann; Fruehling and Oppermann; Braun; James; Muller, Marchand-Alphand, Cuallacci, Nadiras and Muller; Allen; Ruettner; Schoch; Berblinger; Wedler; Fischer; Fischer-Wasels; Holstein; Staemmler; Johnstone; Chabr; Waetjen and others).

The concept that silicosis may even exert a certain protective effect against the development of lung cancer, especially during advanced stages of the disease, has found several proponents because they could show, that an inverse relation seems to exist between the grade of silicosis and the relative liability to cancer of the lung (Spoer-Lein; Schoch; Mittmann; Bauer; Meiklejohn). Additional support for this claim is received by observations made by Rostoski and Saupe on Schneeberg miners, since cancers of the lung among these miners were found to be exceptional if a severe silicosis existed. Similar correlations were recorded by Bonser, Faulds and Stewart; and Faulds to exist for the silicotic changes and lung cancers seen in English hematite miners (Table 2).

Table 2. *Distribution of Lung Cancer in Relation to Grade of Silicosis* (Mittmann) (1950—1957)

	Minimal Silicosis	Light Silicosis	Medium Silicosis	Severe Silicosis	Total
Silicosis with Lung Cancer					
Cases	165	154	81	40	440
Percentage	37.5	35.0	18.4	9.1	
Silicosis without Lung Cancer					
Cases	1,515	1,769	1,480	1,187	5,951
Percentage	25.5	29.7	24.9	19.9	

The available data on the age distribution at death of individuals suffering from silicosis and cancer of the lung are rather scanty and do not reveal any striking or significant changes from the ordinary age distribution of lung cancer (Table 3), unless

Table 3. *Age Distribution at Death from Silicosis Lung Cancer*

Years	30–39	40–49	50–59	60–69	70 & over	Total
Cases	1	7	16	12	1	37

the observations of Fruehling *et al.* can generally be applied. These authors recorded an average age of 53.36 years at death for silicotics with lung cancer, while this age stood at 62.87 for individuals with lung cancer without silicosis. It is proposed that the silicotic complication accounts for this distinct shift into an earlier age group. It does also not appear that the distribution pattern of histologic types of lung cancers found in coexistence with silicosis presents any deviations from the norm (Table 4). Lung cancers in silicotics likewise seem to be located more often at the

Table 4. *Histologic Types of Lung Cancers in Silicotics*

Squamous Cell Carcinoma	Round and Oat Cell Carcinoma	Adenocarcinoma	Total
16	20	1	37

hilum and in the upper lobes than in the lower lobes, where the majority of asbestosis cancers are situated.

Attempts to produce cancers of the lung in experimental animals (mice, guinea pigs) by exposing them to dust of silica or silicon carbide, respectively, have yielded equivocal results since adenomatoid formations in both species occur also on a "spontaneous" basis (Campbell; Willis and Brutsaert). Of more definite significance in regard to carcinogenic properties of quartz, a macromolecular silicon oxide, are the experiments of Ducreay and Schmaehl. These investigators observed the development of four (4) sarcomas in the abdominal cavity in 29 rats intraperitoneally implanted with finely powdered quartz sand, and interpreted this result as an indication of a weakly carcinogenic action of quartz. Sarcoma formation apparently did not occur in rats following a subcutaneous deposition of quartz sand and after an intraperitoneal and subcutaneous implantation of powdered glass, indicating

CAPCO KIN 0000078

thereby that a chronic mechanical irritation alone does not provide a carcinogenic stimulus (Hueper and Payne; Druckrey and Schmähl; Hueper).

From the evidence on hand it appears that a well developed or advanced silicosis does not seem to furnish a favorable soil for the subsequent development of cancer of the lung. It is likely that any extensive fibrosis and hyalinization is likely to interfere with an adequate action of chemical carcinogens which might be embedded in such an oligocellular or acellular matrix. There exists, moreover, the possibility that any microcarcinomas formed in such an ill-vascularized tissue may find it difficult to proliferate or to survive especially in the face of a progressive fibrosis, such as that characterizing silicosis. Whether or not the concept of Kaiyau, that an incipient silicosis provides a more suitable soil for carcinogenesis deserves further consideration as a part of the general problem of carcinogenesis occurring in the vicinity of pulmonary scars (de Biasi).

b) Vegetable and Animal Dust Pneumoconiosis

Among the numerous occupational activities associated with an inhalation of dusts of vegetable and animal matter (cotton, hemp, sisal, cork, sugar cane, wood paper, silk, wool, animal hair, feathers, shellac), some of which give rise to progressive fibrosing pneumoconioses (byssinosis, bagassosis, etc.), only tabacosis has been related by epidemiologic evidence to cancer of the lung, while the possibility of such associations deserves consideration for shellac pneumoconiosis.

a) Tabacosis

Because of the numerous claims made especially during recent years concerning carcinogenic chemicals present not only in tobacco smoke but also in processed tobacco leaves and responsible for the induction of cancers of the respiratory system and of the oral cavity, it is noteworthy that several decades ago dust of tobacco leaves inhaled during the cultivation, harvesting and curing was incriminated on statistical grounds of causing cancer of the lung in cigarette makers (Engel; Rottmann; Brinkmann; Kouwenaar; Koelsch; Seyfarth). In commenting on such claims, Lehmann noted that persons engaged in the tobacco trade are usually heavy smokers, and that this habit is more likely to be the causative mechanism than the inhalation of tobacco dust.

Since more recent epidemiologic studies on the frequency of lung cancer among American workers employed in cigarette factories have failed to show any excessive liability to lung cancer for these individuals, the supposition of Lehmann lacks factual evidence. It is moreover a reasonable suspicion that the chewing of tobacco leaves, particularly when forming a part of the betel nut quid and khaini quid furnishes the main carcinogenic principle responsible for the high incidence of cancer of the oral cavity prevalent among populations in South-East Asia. Apart from any natural carcinogens present in tobacco leaves, consideration also must be given to the fact that such leaves are contaminated frequently with arsenical and chlorinated hydrocarbon pesticide residues and with soot from burnt wood or heavy petroleum oils used during the curing process.

It is at present uncertain whether any of these materials or some others are responsible for the excessive frequency of lung cancer among English grain dockers (Dunner and Hicks).

β) Shellac Pneumoconiosis

In view of the repeatedly reported abnormally high lung cancer incidence among painters (Müller; Durkin and Vant; Fulton; Wynder and Graham), it is of interest that the inhalation of shellac used in lacquers and varnishes and often applied with a spray gun, may elicit a chronic indurative and progressive fibrosing pneumonitis (Hueper and Russell). After purification, shellac consists mainly of hydroxy acids of aromatic and aliphatic hydrocarbons jointed together by lactone and various internal ester linkages. While it will be wise to include shellac in any assessment of cancer hazards to the lung among painters and cabinet makers, members of these trades sustain occupational exposures to various additional respiratory carcinogens, such as chromates, nickel, arsenic, carbon black, aniline dyes used as pigments, solvents and paint removers of coal tar and petroleum derivation, etc. which presumably are more carcinogenic than shellac, if such should be the case.

c) Chronic Chemical Pneumonitis and Bronchitis

Similarly negative epidemiologic observations exists concerning causal relations between various types of chemical pneumonitis and the liability to bronchial cancers in individuals thus affected (acid workers, alkali workers, cement workers, synthetic fertilizer producers, manganese and cadmium smelter workers, epoxy resin producers, etc.), although some workers in such occupations (acid workers, alkali workers, cement workers) develop perforated nasal septa through the corrosive action of the inhaled dust or mist. They thus display exposure stigmata similar to those seen in workers with occupational contact to several specific chemical dusts and fumes implicated in the production of cancers of the respiratory tract (arsenicals, chromates) (Koelsch). The negative evidence on such association available for alkali workers refutes the allegation of Morgan that the respiratory cancers observed in nickel refinery workers are attributable to the inhalation of alkali dust generated in the calcining process.

There is likewise no valid epidemiologic evidence supporting the claim that workers exposed to fumes and mists of mineral acids have an excessive liability to respiratory cancer. The large scale use of such acids (sulfuric acid, hydrochloric acid, nitric acid, fluoric acid, etc.) for a large variety of industrial operations resulting in an occupational exposure of many workers to these agents has not yielded any incriminating evidence (Koelsch; Kreuter; Lickint; Adelstein). These observations are not only of practical but also of scientific importance, because these agents have been accused of arresting the ciliary movement of the bronchial epithelium thereby decreasing the natural forces of resistance of this tissue to the action of inhaled carcinogens (Kuschner; Falk, Tremer and Kotin).

B. Specific Industrial Respiratory Carcinogens

The evidence concerning an etiologic role in the induction of cancers of the respiratory organs is a great deal more reliable, definite, and comprehensive, on the other hand, for a number of specific occupational respiratory carcinogens. Many of them are, moreover, introduced into the general atmosphere in the form of industrial and industry-related effluents and enter the home environment in the form of consumer goods and economic poisons (Table 5).

CAPCO KIN 0000079

Table 5. *Recognized Occupational Respiratory Carcinogens*

Agents	Sites			
	Lung	Larynx	Nares	Nasal Sinuses
Arsenic	+	+	+	+
Asbestos	+			
Chromium	+	+	+	+
Nickel	+		+	+
Isopropyl Oil	+	+		+
Mustard Gas	+	+		
Coal Tar	+	+		
Mineral Oil	+	+		
Radioactive Chemicals	+			+

I. Significance of Specific Industrial Carcinogenic Irritants

Although the knowledge of specific industrial carcinogenic agents affecting the skin dates back to almost 200 years, the recognition of occupational carcinogens

Table 6. *The Time Table of Discoveries of Occupational Cancers*

Name of Agent	Date	Discoverer	Target Organ	Type of Contact
Chemicals-Organic				
Coal Soot	1775	Pott	Skin	Occupational
Coal Tar (lignite)	1876	von Volkmann	Skin	Occupational
Coal Tar (Bitumen)	1892	Butlin	Skin	Occupational
Coal Tar (Anthracite)	1910	Zweig	Skin	Occupational
Coal Tar (fumes)	1936	Kawamata	Lung	Occupational
Creosote Oil	1920	O'Donovan	Skin	Occupational
Anthracene Oil	1908	Oliver	Skin	Occupational
Paraffin Oil				
(Shale)	1876	Bell	Skin	Occupational
(Petroleum)	1910	Schamberg	Skin	Occupational
Petroleum Coke	1890	Dreuille and Guermonprez	Skin	Occupational
Lubricating Oil				
(Petroleum)	1930	Henry	Skin	Occupational
(Shale)	1910	Wilson	Skin	Occupational
Benzene	1928	Delore and Borgomano	Bone Marrow	Occupational
Hydrogenated Coal Oil (Ileogine)	1960	Senton *et al.*	Skin, Mouth	Occupational
Isopropyl Oil	1947	Nale and Hueper	Nasal Sinus, Larynx, Lung	Occupational
Mustard Gas	1939	Yamagiwa	Larynx, Lung	Occupational
Chemicals-Inorganic				
Arsenic	1822	Paris	Skin	Occupational
	1887	Hutchinson	Skin	Medicinal
	1930	Sauer	Lung	Occupational
Asbestos	1935	Lynch and Smith	Lung	Occupational
Chromates	1935	Pfeil-Alwens	Lung	Occupational
Nickel	1932	Goempels	Nasal Cavity and Sinuses, Lung	Occupational
Radiations				
Ultraviolet Rays	1894	Unna	Skin	Occupational
Roentgen Rays	1902	Frieben	Skin	Occupational
Radioactive Chemicals	1879	Härting and Hesse	Lung	Occupational

acting upon the organs of the respiratory system is only 35 years old, despite the fact that some of these respiratory carcinogens had been known for many decades

to cause skin cancers. The pace of discovery of respiratory carcinogens of industrial derivation has been accelerated during recent years and has resulted in the establishment of a list of suspected and potential chemical carcinogens, some of which doubtlessly will subsequently be found to be carcinogens to the human respiratory organs (Table 6).

a) Classification of Occupational Respiratory Carcinogens

Depending on the amount and quality of evidence incriminating occupational environmental agents in the causation of cancers of the respiratory system, these etiologic factors can be classified into the following three groups:

Recognized respiratory carcinogens
Suspected respiratory carcinogens
Potential respiratory carcinogens

1. Recognized respiratory carcinogens are those agents for which the available medical, epidemiologic, pathologic and experimental evidence is adequate for establishing reliably causal relations between occupational exposures to such agents and the subsequent development of cancers of the respiratory system in man.

The following agents fulfill such requirements:

Arsenicals (inorganic)
Asbestos
Chromates and Chrome Pigments
Nickel
Isopropyl Oil
Mustard Gas
Coal Tar
Mineral Oil
Radioactive Substances

Since occupational cancers are non-intentional experimental cancers obtained in man, they should be assessed in regard to their etiologic significance on the same level as evidence obtained in experimental animals. They in fact provide even more weighty evidence than experimental animals as far as the existence of specific human cancer hazards is concerned because they demonstrate the carcinogenic effectiveness of particular environmental agents in the species man. This consideration is specifically applicable in adjudging arsenicals as recognized human carcinogens despite the equivocal nature of the experimental evidence on hand.

2. Suspected Respiratory Carcinogens are those agents for which the human evidence is at present not entirely conclusive although the available experimental evidence supports directly or indirectly the existence of causal reactions of such agents to the development of cancers of the respiratory system in man.

Environmental Agents which belong to this group are:

Beryllium
Benzidin
Iron Oxide
Soot — Incomplete Combustion Products of Carbon, Petroleum, Wood, Gas
Chemicals Contained in Gasoline and Diesel Engine Exhausts
Thermic Tobacco Derivatives (Tobacco Combustion Products and Volatilized Normal and Artefactual Constituents).

CAPCO KIN 0000080

Table 7. *Suspected and Potential Respiratory Carcinogens*

Agents	Species	Route	Lung	Skin	Subcut. Tissue	Bone	Bladder	Liver	Kidney	Hemat. Tissue	Mucous Tissue
Iron (Iron-polymer Complex)	Man	Respiratory	+								
	Mouse, Rat Hamster				+?						
Beryllium	Rat Rabbit	Respiratory Intravenous	+			+					
Carbamate	Mouse	Parenteral									
	Rat	Oral	+	+				+		+	
Dimethylaminostilbene	Rat	Oral	+	+				+	+		+
Benzidine	Man	Respiratory									
		Oral	+				+				
	Rat Dog	Cutaneous					+	+		+	+
Nitrosamines	Guinea pig										
	Rat	Oral	+					+	+		
Acetylaminofluorene	Rat	Oral	+				+	+	+		+
Isoniacid	Mouse	Oral?	+								
	Man	Subcut.	+?								
Diesel & Gasoline Motor Exhaust	Mouse	Respiratory	+								
	Man	Respiratory	+								
	Mouse	Cutaneous		+	+						
Oxidized Vaporized Gasoline	Mouse	Respiratory	+								
	Mouse	Cutaneous		+	+						
Atmospheric Soot	Mouse	Cutaneous		+							
		Parenteral									
	Man	Respiratory	+								
	Rabbit	Cutaneous		+							
4-nitroquinoline-1-oxide	Rat	Subcut.	+		+						
Silicosis, Bagassosis, Byssinosis	Man		+								
Tobacco Tar	Mouse	Cutaneous	+	+	+						
	Dog	Bronchial									
Aliphatic and Aromatic Epoxides	Mouse	Subcut., Cutaneous	+	+	+						

1. Potential Respiratory Carcinogens are those agents for which the incriminating evidence is predominantly restricted to observations made in experimental animals exposed to these agents being components of local or general human environments incriminated by suggestive epidemiologic evidence in man (Table 7).

Environmental Agents included in this group are:

- Carbamates
- Nitrosamines
- Isoniacid
- Carbon Polymers (PVP, PVA, Polymethane, Epoxy Resins, Carboxymethylcellulose, etc.)
- Oxidized aliphatic and aromatic hydrocarbons (epoxides and peroxides) generated in heated vegetable oils and animal fats and by photooxidation of evaporated gasoline
- Silicosis
- Byssinosis, Bagassosis and related Organic Pneumoconioses
- Acetylaminofluorene

Table 8. *Cancers in Non-Respiratory Organs Elicited by Occupational Respiratory Carcinogens*

Agents	Route of Contact	Connective Tissue	Skin	Liver	Hemato-poietic Tissue	Bones	Alimentary Tract
Arsenic	Cutaneous		+	+			+
	Oral						
	Respiratory						
Coal Tar	Cutaneous		+				
Mineral Oil	Cutaneous		+				
	Parenteral	+					
	Oral						+
Radioactive	Cutaneous	+	+				
Chemicals	Oral				+	+	
	Parenteral			+			

b) Route of Exposure

While the majority of respiratory carcinogens enter the respiratory tract as pollutants (dust, fumes, spray, mist, vapor, gas) of the inhaled air, a few may apparently become active on the pulmonary tissue when introduced into the body of man or animals through non-respiratory routes, i.e., by ingestion, penetration of the skin, or parenteral introduction (arsenicals, benzidine, nitrosamine, acetylaminofluorene; carbamates), or even by transplacental penetration (ethyl carbamate). Some of the carcinogenic atmospheric pollutants are rather stable (chromates, nickel, arsenic, radioactive substances, asbestos), whereas others are changed and inactivated by chemical and photochemical reactions to which they are subjected in the air (polycyclic aromatic hydrocarbons, such as 3,4-benzpyrene). Climatic conditions and associated non-carcinogenic pollutants (particulate and gaseous) influence the quality and quantity of the atmospheric carcinogenic spectrum and its individual components.

CAPCO KIN 0000081

Although some of the respiratory carcinogens have been constituents of the human environment for thousands of years, most of them are products of modern industrialism and all of them have been polluting the air to an increasing degree during the past century. Three fundamental types of respiratory exposure to these carcinogens can be distinguished:

1. Occupational exposure to specific carcinogens in specific industrial operations. Since the degree of exposure is, as a rule, more severe under these conditions than under any other ones, incidence rates of respiratory cancers among some of the exposed worker groups are also higher than those noted from any other types of exposure. All recognized respiratory carcinogens are involved in the production of occupational respiratory cancers and have, moreover, furnished the bulk of the epidemiologic evidence incriminating exogenous agents in the production of respiratory and nonrespiratory cancers in man. The first discovery of occupational cancers of the lung dates back as early as 1879 when the high incidence of lung cancer among Schneeberg miners was traced to, at that time, non-definable occupational factors.

An occupational contact with carcinogens is not necessarily restricted to workers who produce, process or handle directly such agents but not infrequently exists also for workers employed only temporarily in such operations (maintenance and repair men) or who work near such operations, such as yardmen, truckers, packers and loaders, or who are employed in other jobs near carcinogenic operations carried on in the same room or building or in nearby buildings.

2. Atmospheric pollutants of local and general distribution provide the second type of exposure to respiratory carcinogens. Carcinogens disseminated in the general atmosphere originate from various chemical and radioactive effluents emitted from smokestacks, chimneys of plants, houses, and ships, from exhaust pipes of automobiles, busses, trucks and railroad locomotives, from dust of oiled, asphalted and tarred roads, from radioactive fallout of atom bomb explosions and from chemical fallout of pesticide drifts. Local carcinogenic effluents may be found within the vicinity of plants in which carcinogenic materials are produced, used, processed, and handled and along the roads on which they are trucked. Locally restricted air pollution of carcinogenic nature may be connected with the use of chromates and carcinogenic mineral oils in air conditioning equipment and of anticorrosive chromates in the water of steam heating plants of homes and office buildings, with the employment of asbestos in insulating material in homes and the use of carcinogenic pesticides and herbicides in homes and on lawns. Local or general types of carcinogenic respiratory exposure are connected with the dietary consumption of foodstuffs contaminated with arsenical pesticide residues or other carcinogenic contaminants of foodstuffs.

3. Habitual exposure to carcinogenic air pollutants of a personalized type, which in contrast to the two previously mentioned ones is voluntary, is associated with the smoking of tobacco, especially in the form of cigarettes. Similar voluntary exposures to the inhalation of respiratory carcinogens may be connected with the spraying or nebulizing of hair lotions and hair lacquers containing carcinogenic ingredients, such as 8-hydroxyquinoline, creosote, arsenicals, and various carbon polymers, such as polyvinyl pyrrolidone and polyvinyl alcohol. A voluntary type of carcinogenic exposure is associated also with the consumption of arsenicals and mineral oils for certain medicinal reasons. A similar iatrogenic mechanism may account for the marked and increasingly often reported cancers in tuberculous lungs of patients treated with antituberculous chemicals (isoniacid).

It is apparent from this classification of exposure types that during recent decades technologic developments have spread respiratory carcinogens originally mainly active among members of restricted occupational groups not only to ever larger and more general industrial worker groups but also have disseminated such in part highly potent agents through industrial and industry-related wastes from occupational environments into local and general environments where they have contact with the population particularly its urban and industrialized components.

2. Occupational Respiratory Cancer and Smoking

During the past decade numerous investigators have attempted by comprehensive biostatistical studies and experimental investigations to determine the relative causal role which cigarette smoking allegedly plays in the induction of cancer of the lung, larynx and several non-respiratory organs such as the oral cavity, esophagus, stomach and bladder, and has contributed within the last 50 years to the alarming rise in frequency of lung cancers. A rather modest effort has been made during this period, on the other hand, of ascertaining equally comprehensive and pertinent information on the same etiologic and epidemiologic aspects of respiratory carcinogenesis as they apply to the various recognized environmental carcinogens which, in part are evidently not only considerably more potent than those apparently present in cigarette smoke but which have also much more prolonged and intense contact with large portions of the general population. An exposure to such atmospheric factors often lasts 24 hours a day and starts with the most susceptively neonatal age period and lasts throughout the entire life-time. This quantitatively and qualitatively disproportionate etiologic information on respiratory carcinogens available for these factors has tended to produce a distorted assessment of the relative significance of the various carcinogens in etiologic and epidemiologic respects and has interfered with the development of an over-all balanced programmatic approach to an effective prevention of respiratory cancer hazards of all types and from all sources.

This interpretation of the prevailing situation is supported by the following observations. Critical analyses of the causal environmental background of the excessive incidence of lung cancers among chromate workers, employees in asbestos plants and trades, and radioactive ore and hard rock miners, have demonstrated that such phenomena could not be attributed to cigarette smoking as a predominant etiologic factor, but were due to occupational exposures to specific chemicals (Bidstrup and Case; Settikoff, Ching and Hammond; Wagoner *et al.*; Parsons, de Villiers, Bartlett and Beckett). Symptomatic and epidemiologic evidence supporting this view in connection with lung cancer in chromate workers is contained in the reports of Atwens *et al.*; Fisher; and Gafafer *et al.*

Atwens *et al.*, in an early publication on the subject of chromate cancers of the lung, pointed out that an abuse of tobacco could not be demonstrated in most of his patients. Gafafer *et al.* recorded that 81.1% of the chromate workers with lung cancers and that 79.4% of the foundry workers used as controls had been smokers. These investigators noted, moreover, that the white chromate workers smoked more heavily than the colored ones.

CAPCO KIN 0000082

10. Petroleum — Mineral Oil — Wax — Asphalt — Petroleum Carbon — Carbon Black — Methylated Naphthalene — Combustion Products — Shale Oil and Derivatives

a) Technological Aspects

Mineral oils and related products, such as waxes, tars, asphalts, and pitches, can be obtained by the distillation and fractionation of various natural raw products, such as petroleum, oil shale, bituminous coal, natural asphalts, and hydrogenated coal (Hueper; Goldblatt and Goldblatt; Page *et al.*; Lijinsky). Since these raw products vary according to their derivation among each other as well as among members of the same group in their chemical composition, and because this quality is distinctly influenced for their derivatives by the types of processing procedures used, the great majority of these products lacks any definite chemical uniformity and standardization. Nevertheless, the general rule can be applied that derivatives which have been obtained by the application of high temperatures resulting in the formation of cyclic compounds (Auld) or are the result of cracking processes (Hieber *et al.*) contain polycyclic aromatic hydrocarbons, some of which are recognized and potent chemical carcinogens to man and animals (Hieger and Woodhouse; Twort and Ingram; Ivy, Priestley, Reisner and Hale; Shubik, Saffiotti, Lijinsky, Pietra *et al.*; Lijinsky, Donsky and Rasia; Eichhorn and Titschack; Terribus, Thomas and Mirat).

Although it has been claimed that only such products having a high boiling point are carcinogenic, human and experimental observations definitely show that also derivatives distilling over at a boiling point below 700 °C, such as methylated naphthalenes, may possess carcinogenic properties (Shubik and Saffiotti; Hueper and Cahnmann; Andervont; Poel; Horton, Denman and Trowell; Kotin, Falk and Thomas; Lushbaugh; Lushbaugh and Hackett)

In fact, there exists an increasing amount of evidence incriminating not only aromatic components of mineral oils and related chemicals in the production of cancers, but also aliphatic chemicals such as paraffins, aliphatic epoxides (ethoxylized gasoline) and nitro olefins (Shubik, Saffiotti, Lijinsky *et al.*; Kotin, Falk and McCammon; Kotin, Falk and Thomas; Kotin and Falk; Jussawalla; Deichmann)

The carcinogenic properties of these materials is being attested by numerous reports relating the development of cancers of the skin, including scrotal skin, in various types of worker groups having an occupational contact with them (lubricating oil, paraffin oil, cooling oil, waxes, fuel oil, asphalt and coke of stills, plasticizers in tiles, fillers in rubber, electrode components, etc.) as well as in several species of experimental animals to which they were applied or injected (Henderlite, Berry, Ligne and Thorpe; Ligne; Southam and Wilson; Henry; Waib; Eckardt; Holt; Page *et al.*; Smith and Sunderland; Cruickshank and Gunn-Leveen; Cruickshank and Squire; Auld; Brieger-Bank; Squire, Cruickshank and Tuffley; Fife; Gilman and Vesselinovitch; Mastromatteo; Spink; Raynor and Tomlinson; Hueper and Payne; Simmers; Hueper and Cahnmann; Steinbrocker and Cara; Wynder; Sunderland, Smith and Sugiura; Twort and Twort; Venamal; Cook, Carruthers and Woodhouse; Winkhouse; Lijinsky *et al.*; Waib; Mac Kenna and Hueper). The great majority of the occupational oil cancers of the skin were reported from Great Britain. Not more than 10% of the observations originated from the United States despite their much more extensive production and use and a greatly higher production of petroleum derivatives in the U.S.A. than in Great Britain. As a partial explanation of this astounding phenomenon, reference may be made to a remark of Eckardt who stated that, "the carcinogenicity of cutting oils is of such a low degree that good personal and industrial hygiene practices should eliminate any cancer hazard associated with these materials". The perhaps industrially unpleasant fact nevertheless exists — despite this admonition of taking rather lightly possible cancer hazards from such agents — that cancers of the skin from occupational contact with cutting oils have been observed in American metallurgical establishments. They regrettable, however, have not been made a matter of public record although such effects were demonstrated also in experimental animals (Hueper and Payne). Litigations regarding such cases were rather settled out of court. The occurrence of skin cancers in man and experimental animals from exposure to cutting oils, on the other hand, has been reported by Canadian investigators (Mastromatteo; Gilman and Vesselinovitch).

Only one American oil company has chosen to publish its more recent experiences on the occurrence of cancers of the scrotal skin in paraffin pressers (Henderlite, Berry, Ligne, and Thorpe; Ligne and Dannison) and has done this only after a delay of ten years when the paraffin pressing process for obtaining waxes had been replaced by the solvent process, although wax cancers have been known for many years (Davis; Lockhart; Hueper). Since similar conditions of exposure to carcinogenic oils from which crude or "slack" wax is pressed have prevailed in other oil companies, according to reliable observations, it stands to reason that some such cancers must have occurred also in employees of these companies. Whether many of the victims of these occupational petroleum wax cancers received compensation for having contracted an often fatal occupational paraffin oil cancer, appears to be doubtful because of the statutory time clause which limits the making of such claims. It is also symptomatic of the general policy adopted in the management of information on such matters that the very extensive experimental data on carcinogenic properties of petroleum products obtained at a Midwestern university under the sponsorship and with the financial support by the American Petroleum Institute during twelve years of research, have not been published in printed form but seem to be considered still as "privileged information" if Eckardt's philosophy in such matters should have been adhered to. The observation on oil cancers has suffered the same fate, which was assigned to a similar study on coal tar cancer hazards, which was conducted at the same university during the same period, and which was carried out under the sponsorship of a group of coal tar producers who had been stimulated by Hueper to engage in such research in 1950.

A disconcerting amount of human and experimental evidence attests to a carcinogenic effect of fully-refined hard, soft and liquid paraffin products not only on animal tissues but also on human tissues when applied to the skin, ingested, inhaled, implanted into the lumen of the urinary bladder, or parenterally injected (Colton; Shubik; Schmähl and Reiter; Boyd and Dibb; Hueper; Druckrey, Schmähl and Preussmann; Neubauer; Shubik *et al.*; Bonser, Butland, Busby and Clayson; Bonser, Clayson, Jull and Pyrah; Quray; Mohr; Bonser, Clayson and Jull, Postler and Robertson; Irving, Gutmann and Larson). Shubik *et al.* reported the presence of 1,2,5,6-dibenzanthracene in fully refined paraffins used for the coating of milk containers, and Prokhorova and Znamensky recorded the

CAPCO KIN 0000083

lung. They can only be ascribed to quantitative and qualitative variations in the *exposure conditions to mainly* still unidentified environmental and occupational respiratory carcinogens.

Additional evidence on differences in occupation related differences of lung cancer mortality rates have been recorded by WYNDER and GRAHAM; BURNET, POCHE, MITTMANN, and KNELLER; TURNER and GRACE, and others. It appears

Table 17. *Standard Mortality Rates of Malignant Neoplasms of the Respiratory System in Occupational Classes in Scotland* (MORRISON)

Occupational Code No.	Occupation	RMR Above 130
160—164	Platers, riveters, shipwrights	183
231—249	Electrical apparatus makers, electricians	170
131, 132	Moulders	162
589	Masons and stone cutters	162
134—138	*Foundry workers, etc.*	161
681	Dock laborers	157
912	Crane drivers	150
600—609	Painters, decorators	132
		Below 70
019, 021, 029	Farm workers	25
010, 011, 018, 020	Farmers, etc.	27
110—119	Foremen & overlookers in metal manufacture	54
013—015	Market or other gardeners	56
670—679	Managers or *industrial undertakings* other than managers of office departments	69

Table 18. *Mortality from Lung Cancer and All Causes, Standardized Mortality Ratios by Major Occupation Groups in California Men, Aged 20 to 64, 1949 to 1951*

Major Occupation Group		Lung Cancer		All Causes S M R.	Occupation Reporting Bias[1]	
Number	Title	Deaths	Actual S. M. R		Number	Ratio
	All reported occupations		99	96		
1	Professionals, etc.	151	84	90	24/18	133
3	Managers, etc.	269	76	83	17/17	100
4	Clerical, etc.	97	86	82	14/14	100
5	Sales	152	103	97	22/23	96
6	Craftsmen, etc.	567	120	95	92/82	112
7	Operatives, etc.	278	105	93	36/47	77
8—9	Service workers	202	110	109	44/55	80
11	Laborers	203	119	142	31/32	103
2	Farmers	111	94	93	11/6	183
10	Farm laborers	61	54	90	4/10	40

[1] Number on death certificate divided by number according to occupational history. Histories were obtained by interview with hospitalized lung cancer patients who were subsequently traced on routine state death records (BREslow).

from these studies that workers employed in the metallurgical industry, painters, decorators, and mechanics are distinctly more often affected by lung cancer than farmers and agricultural laborers as well as coal miners. There is no evidence nor is

it conceivable that such variations in lung cancer frequencies for different worker groups are in any way causally associated with demographic differences in cigarette smoking habits. This argument is applicable with equal force to the etiologic factors responsible for the occupational lung cancers of women working in smoke filled kitchens or inhaling smoke from braziers who develop lung cancer at a high rate, such as the Mexican women in Southern California (STEINER; BUECHLEY, DUNN, LINDEN and BRESLOW) or at a rather young age, such as the Bantu women in South Africa (HURWITZ)

4. Pluripotentiality of Respiratory Carcinogens

Respiratory carcinogens display to a remarkable degree pluripotential properties. This phenomenon is in part due to the fact that carcinogenic agents inhaled with the environmental air come in contact not only with the mucosal lining of the respiratory tract, but invariably also with that of the alimentary tract by being swallowed with the saliva and nasal secretion, as well as with the epidermis of the skin. The observation of cancers in non-respiratory organs in individuals exposed to atmospheric carcinogens, therefore, should serve as a warning of simultaneously existing cancer hazards to the respiratory system. The experiences obtained in the past with the discovery of occupational lung cancer hazards related to previously recognized skin carcinogens furnishes an adequate illustration in support of such correlations. It can be expected that this pattern of multiple target organs of respiratory carcinogens applies also when presently available observations are restricted to the respiratory organs. It is remarkable therefore that this biologic principle generally valid for occupational carcinogens does not hold apparently for exposures to cigarette smoke. Despite the fact that there exist definitely many more heavy cigarette smokers than coal tar workers and cobblers who have developed cancer of the fingers and hands from exposure to carcinogenic tar and pitch, cancers of the fingers often deeply brown stained by a prolonged and intense contact with cigarette tar have not been observed in chain smokers. A similar discrepancy exists regarding the apparent absence of cancer of the lip in cigarette smokers whose labial mucosa is constantly bathed in the tarry juice oozing from the tip of the cigarette. Lip cancers, on the other hand, have been recorded in tar workers as well as in fishermen keeping the tarry threads and the tar contaminated needle used during the repair of nets between their lips (HUEPER). It is improper to invoke as an explanation for such differences in action between cigarette tar and coal tar a hypothetical variation in tissue susceptibility especially since cigarette tar is capable of inducing cancer of the skin in mice, and as claimed, is present in a concentrated form in the butt of cigarettes.

5. Carcinogenic Symptom Complex

All known respiratory carcinogens elicit in man in addition to cancers in different parts of the respiratory system also a complex of symptoms which in part is characteristic for a particular carcinogen and which reflects its toxic action on the respiratory mucosa as well as other tissues.

CAPCO KIN 0000084

Arsenic: Perforated nasal septum, bronchitis, metaplastic changes in bronchial mucosa, chronic dermatitis, melanosis of the skin, leukoderma, hyperkeratoses of palmar and plantar surfaces, neuritis, cirrhosis of the liver, obliterative arteritis in lower extremities, multiple cancers of the skin, liver, lung, esophagus, etc.

Asbestos: Asbestos warts of the hands and forearms, bronchitis, progressive fibrosis of lung of diffuse character and involving lower lobes first, focal emphysema, adenocystic degeneration of bronchioli, thickening and calcification of pleura, asbestos bodies in sputum, squamous cell metaplasia of bronchial mucosa, atypical carcinosis of abdominal cavity, peritoneal mesothelioma, mesothelioma of pleura, carcinoma of lung.

Chromates: Chronic dermatitis with chrome holes (indolent ulcers) on hands and forearms, perforated nasal septum, chronic rhinitis, chronic ulcerative bronchitis, chronic laryngitis, chromitosis of lung, chronic chemical pneumonitis, chronic ulcerative gastritis and colitis, cancer of lung.

Nickel: Chronic dermatitis, chronic bronchitis, chronic chemical pneumonitis, adenocystic degeneration of bronchioli, chronic rhinitis, carcinoma of nares and paranasal sinuses.

Radioactive Chemicals: Chronic bronchitis, radiation pneumonia, anemia and leukemia, hypoplastic and hyperplastic changes in bone marrow, cancer of lung, cancer of nasal sinuses.

Coal Tar: Chronic dermatitis, tar warts, melanoderma, cornified horns on exposed skin, chronic rhinitis with loss of sense of smell and taste, bituminosis of lung, chronic bronchitis, papillomas and cancers of skin, cancer of lung.

Mineral Oil: Chronic dermatitis, melanoderma, warts, papillomas, chronic chemical pneumonitis (lipoid pneumonia), cancer of the skin at sites of principal exposure (hands, forearms, face, neck, scrotum, feet, lower extremity), cancer of the larynx, cancer of the lung.

Crude Isopropanol: Chronic sinusitis, nasal polyps, cancer of the larynx, nasal sinuses, lung.

Mustard Gas: Chronic dermatitis, chronic rhinitis, laryngitis, and pneumonitis, emphysema, bronchiectases, cancer of the lung, larynx and nasal sinuses.

These etiology specific symptom complexes represent in part exposure stigmata. They occur in many but not all individuals with these occupational cancers. Their appearance may precede often by many years the manifestation of the cancer.

6. Sex Distribution

With the exception of asbestos cancers of the lung and cancers of the nasal sinuses after exposure to radioactive gases or dust in luminous dial painters, the occurrence of all other occupational cancers of the respiratory system has been limited so far to members of the male sex. This sex distribution reflects and is the result of the exclusive employment of males in the various occupations with respiratory cancer hazards. Whenever females were equally exposed to occupational respiratory carcinogens, they exhibited a liability to cancer comparable to that seen in males.

7. Occupational "Neighborhood" Cancers

Recent observations on individuals living in the vicinity of industrial operations with occupational respiratory cancer hazards (coal tar fumes, chromate fumes, asbestos dust, beryllium dust) (FIRKET; GROSS; WAGNER *et al.*; KIMINA; SARUTA *et al.*; FERSHTUDT; BOURNE and RUSHIN; WALTERS; WEBSTER; THOMSON; EISENBUD *et al.*), have revealed that industrial respiratory cancer hazards were spread into the immediate environment of plants in which such chemicals were produced or handled and were found along the roads on which industrial carcinogens were transported. Characteristic pulmonary lesions (asbestosis, berylliosis) were found in environmental residents as well as in consumers using such materials in their household and also in animals living in such environments (NIEBERLE; WEBSTER, KIVILUOTO). Industrial carcinogens thus have produced not only endemic "neighborhood pneumoconioses and cancers" but presumably also nonoccupational "household cancers of the lung".

As the result of general intraplant contaminations of the air, occupational lung cancers have been seen, moreover, in workers who were not directly employed in carcinogenic operations but were engaged only transitorily in such operations for repair and maintenance work or were employed in adjacent buildings, or did yard work in the vicinity of such buildings (GROSS) or performed work of non-carcinogenic nature, but were brought in direct contact with carcinogenic chemicals handled by other workers in the same operation (SELIKOFF *et al.*). The existence of such "occupational association" exposures has rarely been considered in past epidemiologic investigations on an occupational causation of cancer in man.

Equally important in this respect should prove more comprehensive epidemiologic studies on the scatter pattern of occupational respiratory cancers in worker populations, as well as in the general population, along the lines of the known "traffic pattern" of specific carcinogens. Such studies should start with the original production operations of the carcinogens. They should follow them through the consuming industries and trades and finally be applied to the home environment of the ultimate public consumer as well as to the local and regional general environment. The ultimate consumer becomes exposed to these agents not only when they are present as ingredients, impurities and contaminants of consumer goods but also when they pollute water, air, soil, fauna, and flora (HUEPER; KIVILUOTO; WAGLER; MUELLER and ANSPACH; NEWHOUSE).

8. General Periplant Dissemination

The existence of respiratory cancer hazards in the immediate intraplant and extraplant environment has been demonstrated by the presence of several types of respiratory carcinogens in such areas. The spread of occupational cancer hazards in accordance with their known "traffic pattern" has also been proven. It stands to reason therefore that a similar, while mitigated effect, of the various occupational and industry-related respiratory carcinogens present in the general air, especially of cities and industrialized regions, accounts for a significant portion of the respiratory cancers occurring in the general population. There are good reasons for assuming that

CAPCO KIN 0000085

industrial atmospheric pollutants are responsible in part, not only for the alarming increase of lung cancers during recent decades but also for the distinctly higher lung cancer rates in urban populations over rural ones (COMMINGS, HAMELEN, HUEPER, KOTIN and FALK; STOCKS; STOCKS and CAMPBELL; HAMMOND, CURWEN, KENNAWAY and KENNAWAY; PYBUS).

9. Carcinogenic Potency and Attack Rates of Industrial Respiratory Cancers

The high carcinogenic potency of most industrial respiratory carcinogens is reflected in the highly excessive attack rates of respiratory cancers affecting various parts of this system (nares, paranasal sinuses, larynx, bronchi) according to observations in various circumscribed and usually severely exposed worker populations (Table 19). This fact receives additional support from the evidence that the carcinogens involved are capable of producing in most instances, cancers in several organs and in several species when introduced into experimental animals by the same or different routes.

Table 19. *Attack Rates of Occupational Respiratory Carcinogens*

Chemical	Site of Cancer	Incidence in Population in Risk	% of All Cancer Deaths	Attack Rate: Morbidity Rate per [illegible]	Attack Rate: Mortality Rate per [illegible]
Arsenic	Lung	—	—	—	145.7 males (10.9 normal)
Asbestos	Lung	—	—	12 × normal	(13.2 - 50.0% of all autopsies on asbestotics) (1 normal)
Chromium	Lung	—	—	42 × normal	146 - 338
Nickel	Nares, Paranasal Sinuses	329:100,000 574:100,000	—	20 × normal	--
Radioactive Chemicals	Lung	—	—	—	(50 - 80% of all deaths)
Crude Isopropanol	Paranasal Sinus, Larynx	10:100	—	134.5 (normal 6.5)	--
Coal Tar	Lung	500:100,000	45%	—	--
Mineral Oil	Lung	2,000:100,000	55%	—	--

10. Age Distribution

It is a well-established experience in occupational and experimental chemical carcinogenesis that optimal exposures to potent carcinogens sustained at an early adult period of life often lead to a shift of the age peak of cancers produced into an earlier period of life than that seen with the same type of cancer found in the general population which is often less intensely exposed to same agents.

The data recorded indicate that there is a distinct shift toward younger age groups demonstrable only for cancers of the lung induced by exposures to chromates and chrome pigments and to radioactive chemicals (Table 20). Most occupational lung

Table 20. *Age Distribution of Occupational Cancers of the Lung, Nose, Larynx, and Pleura in Percentage of Total Number*

Years	0 - 20	20 - 30	40 - 40	60 - 50	60 - 80	70 and over	Total number of cases
			Percentages				
Carcinogen							
Arsenic	1.2	3.6	22.2	45.7	21	6	81
Asbestos: Carcinoma	0	6.6	19.0	32.0	21.3	3.2	122
Mesothelioma		23	31	23	23	0	40
Chromium	0.8	15.7	25.5	33.3	22.5	2.2	102
Nickel: Lung	0	1	6	50	41	2	75
Nose		0	0	41	55	4	29
Coal Tar	0	9	24	20	25	22	58
Mineral Oil	0	0	0	58	42	0	12
Mustard Gas	0	5	15	47	33	0	19
Radioactive Chemicals	7	36	27	19	11	0	83
Controls General	6	12	24	34	21	3	1,792
Silicosis	0	2	21	43	32	2	100

cancers do not differ in this respect from those allegedly caused by excessive cigarette smoking and seen in the general population.

It is likely that the absence of a distinct shift in the age distribution of the majority of industrial respiratory cancers is related to the fact that the age of onset

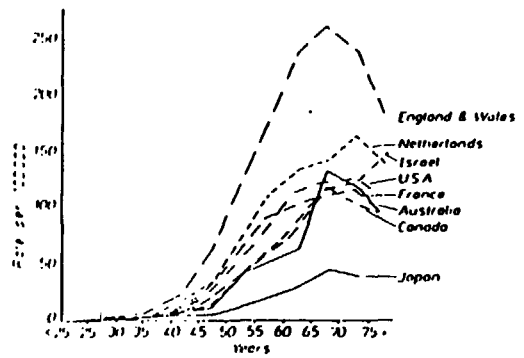


Fig. 1. (A. J. Pomerantz)

of exposure to the occupational carcinogen is, as a rule, at an adult age and that the degree of exposure to the various carcinogens is not sufficiently high for shortening significantly the length of the latent period. Observations on chimney sweep cancer of the scrotum (HUEPER) and on occupational aromatic amino cancer of the bladder

CAPCO KIN 0000086

dular proliferations and adenocarcinomas may at times be difficult to distinctly more definite character as to the production of cancers of different histologic types in the lungs of rats are the observations recently reported by Saffiotti and by Shimkin. These investigators succeeded in producing carcinomas of the bronchial epithelium by introducing into the trachea of rats carbon particles to the surfaces of which known polycyclic aromatic hydrocarbons (3,4-benzpyrene; 7,12-dimethylbenz(a)anthracene) were adsorbed. Through this manipulation a prolonged action of the carcinogen on the bronchial mucosa was obtained, since the carcinogen was only gradually released from its binding to the carbon particles. It may be mentioned that probably a greater part of the carcinogenic polycyclic aromatic hydrocarbons present in polluted air of coal tar operations as well as in urban areas, exists in this type of binding and does not consist of free molecules, as this has been assumed for aromatic carcinogens in cigarette smoke. The experimental evidence cited indeed suggests that carcinogens in free molecular form in the inhaled air are apparently carcinogenically less effective than those attached to the surfaces of particulate matter, such as carbon or iron oxide

Fig. 43. Cornified squamous-cell carcinoma of the skin of a mouse painted with condensate of coal tar fumes

The inhalation of tarry matter present in the dust obtained from tarred roads (Campbell), or produced by the burning of bituminous coal and used as bedding material (Stelig and Bengtsen), caused an increase in the number of pulmonary tumors occurring also spontaneously in mice. No such effect, however, was elicited when mice inhaled directly the smoke from burning bituminous coal (Schroeder and Hawthorne) or when lamp black was employed as bedding material (Stelig and Bengtsen) or when they inhaled the heavily polluted air of central Glasgow (Pea-

cock), or when they became exposed to the fumes given off by heated coal tar (Mentschikowa and Krasser; Hueper and Payne). Similarly equivocal results were observed when rats and guinea pigs inhaled for up to two years, coal tar fumes or soot obtained from smokestacks of coffee roasting plants although condensed coal tar fumes as well as coffee soot displayed definite carcinogenic properties when subcutaneously or intramuscularly injected into rats and mice (Hueper and Payne) (Tables 66 and 67), (Fig. 43).

Table 66. *Neoplastic Reactions in Rats, Guinea Pigs, and Hamsters Inhaling Maximal Tolerated Doses of Fumes from Heated Coal Tar and Petroleum Asphalt, Cutting Oil Fog, Coffee Roast Soot for Up to 24 Months*

Substance	Species	No.	Tumors of Lung: Adenomas	Tumors of Lung: Carcinomas	Neoplastic Reactions at Other Sites: Multiple	Other	Lymph Node	Uterus	Others
Coal Tar Fumes	Rat	75	0	0		6	2		
	Guinea Pig	42	0	0					
Petroleum Binding Asphalt Fumes	Rat	65	0	0		3	2	1	
Cutting Oil Mist	Rat	105		1		1			
	Guinea Pig	65	0	0					
Coffee Roast Dust	Rat	60	3	0		10		1	6
	Guinea Pig	25	2	0	1				

Table 67. *Cancers of the Skin and Muscular and Subcutaneous Tumors of Mice and Rats Produced by the Administration of Condensates of Fumes of Heated Coal Tar and Petroleum Asphalts, of Paraffin Cutting Oil, and of Acetone Extract of Coffee Roast Soot*

Substance	Species	No.	Route of Administration	Cancers at Site of Administration	Tumors Remote from Site of Administration
Coal Tar Fumes	Mouse	50	Skin	22	
Condensate Petroleum Binding	Mouse	50	Skin	1 (?)	
Asphalt Cutting Oil	Mouse	50	Skin	1	2
		100	Muscle		4
Coffee Roast	Mouse	100	Muscle		2
Soot Extract		100	Muscle	1	2
	Rat	60	Skin	1	4
Coffee Roast Soot	Rat	30	Muscle		3
4 Petroleum Road Asphalts	Mouse	250	Skin	2	7
		200	Muscle	3	1
	Rat	120	Muscle	13	16

If thus the experimental production of lung cancers in animals by the mechanism and route of exposure evidently operating in the causation of cancers of the respiratory tract by the inhalation of coal tar fumes and dust has remained a disappointing procedure, this methodologic inadequacy is shared with that of most other known human respiratory carcinogens (Hueper). However, such shortcomings in experimental test methods do not negate the convincing and conclusive evidence provided by clinical and epidemiological data obtained on human population groups exposed to the inhalation of coal tar and pitch fumes and dust and developing cancers of the respiratory system because of it.

CAPCO KIN 0000087

10. Petroleum — Mineral Oil — Wax — Asphalt — Petroleum Carbon — Carbon Black — Methylated Naphthalene — Combustion Products — Shale Oil and Derivatives

a) Technological Aspects

Mineral oils and related products, such as waxes, tars, asphalts, and pitches, can be obtained by the distillation and fractionation of various natural raw products, such as petroleum, oil shale, bituminous coal, natural asphalts, and hydrogenated coal (Hueper; Goldblatt and Goldblatt; Page *et al.*, Lijinsky) Since these raw products vary according to their derivation among each other as well as among members of the same group in their chemical composition, and because this quality is drastically influenced for their derivatives by the types of processing procedures used, the great majority of these products lacks any definite chemical uniformity and standardization. Nevertheless, the general rule can be applied that derivatives which have been obtained by the application of high temperatures resulting in the formation of cyclic compounds (Auld) or are the result of cracking processes (Holt *et al.*) contain polycyclic aromatic hydrocarbons, some of which are recognized and potent chemical carcinogens to man and animals (Hieger and Woodhouse; Twort and Lovelock; Lee, Priestley, Reiner and Hale; Shubik, Saffiotti, Lijinsky, Polera *et al.*; Lijinsky, Domsky and Raiha; Eichhoff and Titschack; Tebbens, Thomas and Murai).

Although it has been claimed that only such products having a high boiling point are carcinogenic, human and experimental observations definitely show that also derivatives distilling over at a boiling point below 700 °C. such as methylated naphthalenes, may possess carcinogenic properties (Shubik and Saffiotti; Hueper and Cahnmann; Andervont; Pole; Horton, Denman and Trosset; Kotin, Falk and Thomas; Lushbaugh; Lushbaugh and Hackett).

In fact, there exists an increasing amount of evidence incriminating not only aromatic components of mineral oils and related chemicals in the production of cancers, but also aliphatic chemicals such as paraffins, aliphatic epoxides (ozonized gasoline) and nitro olefins (Shubik, Saffiotti, Lijinsky *et al.*; Kotin, Falk and McCammon; Kotin, Falk and Thomas; Kotin and Falk; Jonsson; Deichmann)

The carcinogenic properties of these materials is being attested by numerous reports relating the development of cancers of the skin, including scrotal skin, in various types of worker groups having an occupational contact with them (lubricating oil, paraffin oil, cooling oil, waxes, fuel oil, asphalt and coke of soils, plasticizers in tiles, fillers in rubber, electrode component, etc.) as well as in several species of experimental animals to which they were applied or injected (Henderickx, Berry, Lione and Thorpe; Lione; Southam and Wilson; Henry; Waud; Ecrabet; Holt; Page *et al.*; Smith and Sunderland; Cruickshank and Gordiyevich; Cruickshank and Squire; Auld; Broderbank; Squire, Cruickshank and Tofflet; Fife; Gilman and Vesselinovitch; Mastromatteo; Spink; Baynes and Thomson; Hueper and Payne; Simmers; Hueper and Cahnmann; Steinbrecher and Carl; Wynder; Sunderland, Smith and Sugiura; Twort and Twort; Yamamai; Cook, Carruthers and Woodhouse; Woodhouse; Lijinsky *et al.*; Waud; Mac Kenna and Horner). The great majority of the occupational oil cancers of the skin were reported from Great Britain. Not more than 10% of the observations originated from the United States despite their much more extensive production and use and a greatly higher production of petroleum derivatives in the U.S.A. than in Great Britain. As a partial explanation of this astounding phenomenon, reference may be made to a remark of Ecrabet who stated that, "the carcinogenicity of cutting oils is of such a low degree that good personal and industrial hygiene practices should eliminate any cancer hazard associated with these materials". The perhaps industrially unpleasant fact nevertheless exists — despite this admonition of taking rather lightly possible cancer hazards from such agents — that cancers of the skin from occupational contact with cutting oils have been observed in American metallurgical establishments. They regrettable, however, have not been made a matter of public record although such effects were demonstrated also in experimental animals (Hueper and Payne). Litigations regarding such cases were rather settled out of court. The occurrence of skin cancers in man and experimental animals from exposure to cutting oils, on the other hand, has been reported by Canadian investigators (Mastromatteo; Gilman and Vesselinovitch).

Only one American oil company has chosen to publish its more recent experiences on the occurrence of cancers of the scrotal skin in paraffin pressers (Henderickx, Berry, Lione, and Thorpe; Lione and Dennison) and has done this only after a delay of ten years when the paraffin pressing process for obtaining waxes had been replaced by the solvent process, although wax cancers have been known for many years (Davis; Longmire; Hueper). Since similar conditions of exposure to carcinogenic oils from which crude or "slack" wax is pressed have prevailed in other oil companies, according to reliable observations, it stands to reason that some such cancers must have occurred also in employees of these companies. Whether many of the victims of these occupational petroleum wax cancers received compensation for having contracted an often fatal occupational paraffin oil cancer, appears to be doubtful because of the statutory time clause which limits the making of such claims. It is also symptomatic of the general policy adopted in the management of information on such matters that the very extensive experimental data on carcinogenic properties of petroleum products obtained at a Midwestern university under the sponsorship and with the financial support fo the American Petroleum Institute during twelve years of research, have not been published in printed form but seem to be considered still as "privileged information" if Ecrabet's philosophy in such matters should have been adhered to. The observation on oil cancers has suffered the same fate, which was assigned to a similar study on coal tar cancer hazards, which was conducted at the same university during the same period, and which was carried out under the sponsorship of a group of coal tar producers who had been stimulated by Hueper to engage in such research in 1950.

A disconcerting amount of human and experimental evidence attests to a carcinogenic effect of fully-refined hard, soft and liquid paraffin products not only on animal tissues but also on human tissues when applied to the skin, ingested, inhaled, implanted into the bones of the urinary bladder, or parenterally injected (Colton; Schuck; Schmahl and Reiter; Boyd and Dore; Hueper; Druckrey, Schmahl and Preussmann; Neuhaus; Shubik *et al.*; Bonser, Boyland, Busby and Clayson; Bonser, Clayson, Jull and Pyrah; Quilty; Meigs; Bonser, Clayson and Jull, Potter and Robertson; Irving, Gutmann and Larson). Shubik *et al.* reported the presence of 1,2,5,6-dibenzanthracene in fully refined paraffins used for the coating of milk containers, and Prudnikova and Znamensky recorded the

CAPCO KIN 0000088

demonstration of 3,4-benzpyrene in paraffins of Russian make. While petroleum waxes meeting certain physicochemical specifications are permitted in the food industry of the U.S.A., the two Russian investigators recommended that the foodstuff industry should be subject to controls in regard to the use of such waxes. The experimental production of cancers in the subcutaneous tissue of mice receiving implants of pellets of fully refined paraffin in which such impurities of carcinogenic aromatic hydrocarbons were not demonstrable with the most sensitive available methods indicates that a carcinogenic effect of paraffin seems to depend on both aromatic and aliphatic chemical constituents of crude, semi-refined and fully refined waxes.

Apart from the various contacts which human population groups have with these carcinogenic agents for occupational and economic-environmental reasons, such exposures may occur also because of the pollution of some natural media with native petroleum oils. Such petroleum oils and the polycyclic aromatic hydrocarbons contained in them have been demonstrated in the sediments of the Gulf of Mexico (*Whitehead and Berger; Smith; Baker; Mutch and Freimann*) as well as in South African asbestos (crocidolite) (Harington), and in manganese nodules of the western North Atlantic (Thomas and Blumer). These findings indicate a rather wide range of natural occurrence of polynuclear hydrocarbons related to natural types of mineral oils and their prolonged preservation in strongly reduced sediments over many thousands of years. Natural crude petroleum, moreover, has seeped in and contaminated in some areas of the United States, local drinking water supplies. Petroleum and mineral oils from natural sources, as well as from dumping ship fuel oil and escape of engine exhausts into ocean, lake and river waters, especially in or near harbor areas, has been polluting to an increasing degree all bodies of water within or near industrialized countries (Cahnmann and Kubatsuki; Hueper).

It is noteworthy in this connection that non-processed natural bitumen or asphalt, such as that mined from the "asphalt lake" in Trinidad, has not displayed any carcinogenic properties in man (Zeigler) and experimental animals (Hueper), although crude natural petroleum oils, particularly those rich in aromatic compounds, have induced cancers when applied to the skin of mice and rabbits (Hieger and Woolhouse; Twort and Fulton) and may have been involved in the causation of skin cancers in oil field workers (Schwartz, Tulipan and Birmingham).

Carcinogenic constituents of mineral oils and derivatives are emitted into the air in numerous occupational activities where they are used in the manufacture of numerous products (rubber, plastics, steel, linoleum, etc.) or as lubricants, coatings and as fuels. They are present in automobile exhausts and in the effluents of oil refineries and filling stations.

Exposure to various types of petroleum products is rather widespread for the populations of industrialized countries for both occupational and environmental reasons (dietary, cosmetic, medicinal, atmospheric, aquatic, sanitary, etc.) (Hueper). They form constituents of polishes, paints, pesticide preparations, paper and food container coatings, printing materials, water repellents of brick walls and textiles, lubricants, fuel oils, and many other products used in plants and homes (Division of Air Pollution; Hemeon).

b) Epidemiology

Occupational respiratory contact with these products may be due to an inhalation of oil fogs, mists and sprays, such as those encountered under occupational conditions in paraffin pressing sheds, metal lathe operations, spraying of pesticide preparations, investment casting, high pressure lubrication, diesel jet testing, paraffin oil spraying of brick construction, textile spinning, and printing, and complication also exposures to combustion products in automobile and diesel engine exhausts (Jones; Lemon *et al.*; Hueper and Conway; Meyer-Bronnitzer). A habitual and occupational inhalation or ingestion of mineral oil containing nasal and laryngeal sprays creates a similar respiratory contact with paraffin oils and also may cause an oil pneumonia (Lee and Buchan; Proudfit *et al.*; Jamerson *et al.*; Sante; Wood). While it has often been asserted that the ingestion of such oils for laxating purposes may lead to an aspiration of such oils into the lungs and thereby to the development of an oil pneumonia, it is more likely that the oil droplets retained under such conditions in the lungs enter the body through resorption by the intestinal mucosa from where they are transported into the blood of the vena cava inferior, the thoracic duct and the pulmonary arterial system. Here they are retained finally within the pulmonary capillaries (Dawes, Frazer, Fenech and Samuels; Hueper; Meyers and Gruetter; Schneider; Editorial) and thereby give rise to inflammatory and possibly cancerous reactions.

Lung and larynx cancer hazards from occupational exposure to finely dispersed or nebulized oil in the inhaled air have been recorded by Huguenin, Fauvet and Bonnaud for *metallurgical workers, chauffeurs, garage mechanics and engineers.* Kennaway and Kennaway noted a relatively high ratio of laryngeal cancers, but not of pulmonary cancers, in mulespinners having contact with shale oil and showing a high attack rate of cancers of the skin, especially the scrotum and vulva. Southam mentioned that mulespinners developed occasionally multiple primary cancers involving the lung and stomach in addition to the skin. Roesch observed a combination of three primary cancers (skin, lung and stomach) in a paraffin presser; Touraine and Brun also attributed the development of cancer of the lung in members of some occupations to their inhalation of lubricating oil mists. Such exposures may account also in part for the excessive lung cancer mortality among male metal grinders observed by Turner and Grace. A similar observation concerning a special liability to cancer of the lung by metal turners, mechanics, fitters and wood workers was reported by Bernoit. From an epidemiologic analysis of the relation of occupation to cancer of the lung in Japan, Tsuchiya concluded that the only occupational group showing a higher risk to lung cancer were workers exposed to petroleum products.

Additional suggestive evidence on such relationships involving an occupational exposure to oil mist was advanced by Huguenin, Fauvet and Bonnaud, and Huguenin, Fauvet and Mazabraud. The epidemiologic analysis of employees of a large Public Utility Company by Christian also provided evidence in support of the view that an inhalation of oil mists and fumes created an excessive liability to lung cancer since substation operators exposed to oil fumes from interruptors, had a lung cancer rate of 433 per 100,000, chauffeurs had one of 238 and mechanics one of 215, while the average rate was 35.4.

Respiratory exposures to mineral oil fogs, mists and fumes are doubtlessly sustained by workers employed in automobile service stations and garages (Fritton), in rolling mills using the cold reduction of steel strip (Jones), in iron casting operations and steel plants (Lawson) where mineral oil baths are employed for quenching purposes; in asbestos cement plants where mineral oils are used as molding oils (Enca-

CAPCO KIN 0000089

cals from various sources have grown from rather modest importance of often local proportions to problems of major and worldwide significance involving mankind at large.

Several large worker groups and population groups have become affected by this development to an exceptional degree because of their employment in occupations entailing the production of radioactive materials or on account of their exposure to radioactive matter and ionizing radiations released by the detonation of nuclear devices. As the result of the last mentioned events occurring in different parts of the world, the human environment — including food, water and air — have become contaminated with radioactive matter of different types and with different biologic affinities and effects. The increasing use of ionizing radiations in medicine for diagnostic and therapeutic purposes has added to and intensified these exposures for many individuals. Because all types of radiation exert eminent carcinogenic effects on man and experimental animals, this development has been associated with the appearance of a rapidly rising number of cancers in man affecting a variety of organs and tissues which depend on the specific type of radioactive materials active and upon their external or internal route of exposure. Such radiation cancers have been induced as the result of occupational, cosmetic, dietary, medical, military and environmental exposures (Huefer; Aub; Evans; Hempelmann and Martland; Medical Research Council; Glucksmann, Lamerton and Maynford; Zuppinger; Tollis; Warren). Organs of the respiratory system have become involved whenever gases or dust emitting ionizing radiations were inhaled or radioactive matter was directly introduced into the ducts and cavities of the respiratory tract or when penetrating ionizing radiations acted from the outside upon respiratory organs.

b) Epidemiology

Up to some 20 years ago, occupational exposures of the respiratory organs to radioactive agents were limited to relatively small groups of industrial and professional workers (miners and refiners of radioactive ores, especially pitchblende, industrial and medical consumers of radioactive substances, such as gas mantle manufacturers, luminous dial painters, radio tube makers, physicists and radiologists). Non-occupational, medicinal exposures of these tissues to ionizing radiations (x-rays), on the other hand, involved a considerably larger group of individuals, particularly those receiving large doses of x-rays for therapeutic purposes delivered over the chest or neck because of malignant tumors or tuberculous lymph nodes in these regions. Since the advent of nuclear energy production, the manufacture of radioactive isotopes and the explosion of nuclear devices, the number and variety of persons inhaling radioactive gases and dusts have not only grown in the occupational fields but also have become practically universal as the result of radioactive fallout as far as the general population is concerned. Occupational exposures are not infrequently unsuspected by investigators not familiar with industrial practices. They may affect sometimes a much larger number of workers than the ones directly concerned with the operation of diverse devices emitting radioactive energy and particles (undertakers, employees of pathologic institutes, printers, textile and paper makers, cleaning personnel of research laboratories and industrial facilities where radioactive isotopes are employed, sewage disposal workers, etc.).

a) Respiratory Cancers in Radioactive Ore Miners and Millers

aa) Radioactive, Non Uranium Miners

aβ) Lung Cancer in Schneeberg Miners

The oldest known occupational respiratory cancer hazard has been associated for several centuries with the mining of radioactive ores although its exact causal mechanism, i.e., inhalation of radioactive gases and dust, has been recognized only rather recently. The original observations on the frequent occurrence of a chronic pulmonary disease fatal during the prime of life among the miners of the Erzgebirge, on both the Saxon and Bohemian sides, had been noted since the Middle Ages (Agricola in 1500; Matthesius 1559; Pansa in 1607; Schiffler in 1770, etc.) (Pirchan and Sikl; Lowy). The Schneeberg mines located on the northern or Saxon slope of the Erz Mountains were worked since 1410 first for copper and iron, since 1740 for silver, zinc, tin, lead, manganese and magnesium, and at present for bismuth, arsenic, nickel and cobalt, i.e., they were not mined for radioactive ores, such as pitchblende (uranium ore), although such operations may have been introduced since the end of World War II.

The pulmonary ailment affecting the miners at Schneeberg was known for many years before its actual neoplastic character was recognized, as "Bergsucht" (miners' phthisis, or mountain disease). The anatomic nature of this disorder was not discovered until 1879, when Harting and Hesse proved it to be of neoplastic nature. It was diagnosed at that time as a "lymphosarcoma fibromatodes". Since 1926 the studies of Rostoski, Saupe and Schmorl established definitely these pulmonary tumors as carcinomas of the lung, after Arnstein in 1913 had first diagnosed some of these cancers as squamous cell carcinomas. During the interval these occupational pulmonary radiation cancers had become the subject of investigation by various German scientists (Cohnheim, 1882; Ancke, 1884; Arnstein, 1913; Uhlig, 1920; Risel, 1921).

The Schneeberg mines employed at an average 650 miners during the years 1869 to 1877. There was some labor turnover. Death from miners' disease, which, was estimated as cancerous in about 75%, according to Harting and Hesse, removed between 1869—1871, 63 miners, between 1872—1874, 47 miners and between 1875—1877, 40 miners. Kolisch noted that between 1875 and 1912, out of 469 deaths of miners, 276 were due to cancer of the lung (10 to tuberculosis and 183 to other causes). An enquiry among 143 working and retired miners conducted in 1913 by Arnstein revealed that cancer of the lung still existed among the miners. This disease, on the other hand, was absent among 176 workers employed in the ultramarine cobalt factory at the nearby Oberschlema. Saupe found radiographic evidence of lung cancer in eight (8) out of 143 working miners examined.

By 1922 the erroneous opinion prevailed in authoritative circles, that this occupational cancer hazard had ceased to exist (Rostoski). What actually had occurred during these years was a progressive reduction in the number of miners (Arnstein) which had dropped by 1928 from formerly some 800 men to only 116 actually at work, and 38 former miners (total 154), thereby decreasing the size of the effectively exposed worker group. During the preceding three (3) years, 21 of the 154 miners had died. Autopsies performed on 13 of them revealed the presence of a lung cancer in all of them, while clinical evidence indicated the existence of additional lung can-

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cers in two (2) of the eight (8) cases in which a post mortem examination was not made. Thus lung cancer was found in 15 of 21 miners (71 per cent). By 1939, there were only approximately 70 miners employed in the Schneeberg mines. In about 75 to 80 per cent, lung cancer was the cause of death in members of this relatively old worker group (HUECK). The rather frequent multifocal origin of the Schneeberg lung cancers noted by SCHMORL and by BEYREUTHER (25% of the cases) was not evident at that time among the seven cases examined by HUECK. Epidemiologic studies performed at that time on control worker groups, including miners working in non-radioactive or weakly radioactive mines and in plants as well as in the general population in the vicinity of Schneeberg, did not reveal any excessive lung cancer incidence (ROSTOSKI, SAUPE and SCHMORL; HUECK; ROSTOSKI). Schneeberg lung cancers were still observed in 1957 according to a report of SEPKE.

The statistical data on lung cancer rates among Schneeberg miners together with comparative figures for lung cancer rates in the population of Vienna presented by PELLER in 1939 demonstrate adequately the scope of the cancer hazard existing at Schneeberg (Table 70).

Table 70. *Crude Cancer Mortality per 1,000 in Schneeberg Miners*

	Miners in Schneeberg		Vienna Males 15–70 years of age
	1875–1894	1895–1912	1892–1930
Lung Cancer	12.7 ± 1.0	16.5 ± 1.5	0.34
Cancer of Other Organs	2.4 ± 0.4	2.1 ± 0.6	2.1

The exposure time ranged from 10 to 45 years and averaged 25 years. The lag period varied in several former miners between 10 and 17 years (ROSTOSKI; SCHMORL). The average age was during the early period (before 1904) 38 years (UHLIG) and rose to 55 years by 1926 (range 37—69 years (ROSTOSKI, SAUPE and SCHMORL). It was noted by HÄRTING and HESSE that drillers and hewers developed lung cancer at an earlier age and with a higher frequency than other underground workers, such as carpenters and masons. Drillers and hewers, therefore, sustained apparently the most severe exposure to the causal agents (radioactive dust and gas in addition to silica dust, arsenic, etc.) (NEITZEL).

Among 41 cases which were analyzed for their specific histologic type, 26 were squamous cell carcinomas, 14 were small cell carcinomas, some with giant cells (Fig. 44), and one (1) was a multifocal carcinoma which exhibited both small cell and adenocarcinomatous structures. Radiation cancers of the lung as observed among Schneeberg miners thus adhered to the general pattern of histologically diverse responses to the same etiologic agent.

Etiology: During the early period after the discovery of these lung cancers when radioactivity of chemicals was still unknown, it was supposed that the development of these neoplasms was related to the heavy exposure to silica dust, i.e., to silicotic pneumoconiosis sustained by these miners. However, silicosis was, as a rule, not very extensive in miners with lung cancer (ROSTOSKI; SEPKE) and HUECK noted that silicosis had no causal relation to these cancers. Also speculations as to a contributory role of an occupational contact with water in the mines causing a tendency to the

frequent occurrence of colds were advanced (HARTING and HESSE). SCHMORL pointed out that such cancers seemed to originate from pulmonary scars. After the chemical composition of the ore had been ascertained, various metals contained in the ore, such as cobalt, bismuth, nickel, chromium and arsenic, were considered as being causally involved in the production of these tumors (HÄRTING and HESSE; ROSTOSKI and SAUPE). Arsenic attracted special consideration in this respect since the ore contained 0.5 per cent of this mineral (RISEL; ROSTOSKI). It was assumed that fungal growth might tend to volatilize the arsenic present in the ore and thus cause it to be inhaled. However, the miners had no signs of arsenic poisoning and the molds proved to be inactive. This etiologic concept was later more or less

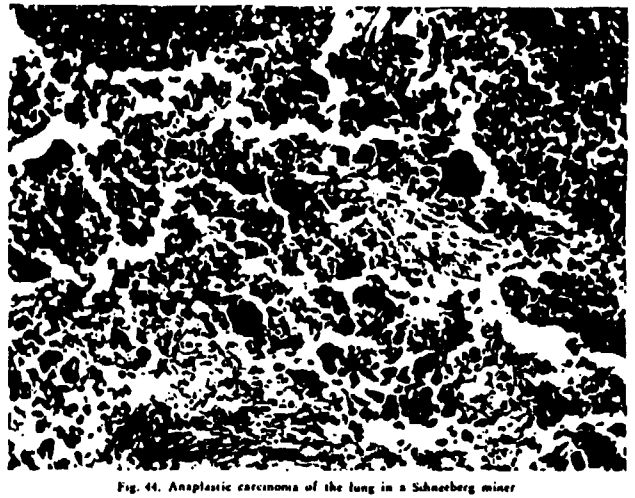

Fig. 44. Anaplastic carcinoma of the lung in a Schneeberg miner

abandoned (SCHMORL; LOUTIT), and arsenic remained merely for some time as a possible contributory factor in the speculations entertained by several investigators on the etiology of these cancers (LORENZ).

VESIN, as well as LORENZ, proposed the hypothesis that also genetic, hereditary factors associated with an assumed inbreeding of the population at Schneeberg might represent a contributory factor. Considering the fact that Schneeberg, around the turn of the century, was a town of 10,000 inhabitants and was supplied with railroad connections with the rest of the world, "inbreeding" as a cause of endemic predisposition in such a community can scarcely be taken seriously.

Following the discovery of radioactivity in the air and dust of the Schneeberg mines after the turn of the century, the causal importance of this factor has received increasing attention. The prolonged inhalation of radioactive matter present in the mine air seems to be at present generally accepted as the real cause of the lung cancers observed for so many years and at such a high incidence among the miners at

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Schneeberg (Ludewig and Lorenser, Schmorl, Rostoski, Bensaude, Rostoski, Teleky; Peller; Rostoski and Saupe; Neitzel; Weber, Fischer-Wasels, Rajewski; Fisco; Schmorl; Gruchmann *et al*). It is remarkable, therefore, that in 1944 Lorenz still claimed that radon was not the sole factor operating in the induction of the lung cancer among Schneeberg miners and that other influences, such as chronic irritation, arsenic, and hereditary susceptibility also played a primary role. He tried to support this opinion by pointing out that studies on other groups exposed to radon or radium, including radium plant workers, presented no clear cut evidence that radium or radon had ever induced lung cancer in man outside the mining district of Schneeberg and Joachimsthal. Since a similarly negativistic assessment as to the predominant significance of inhaled radon and its radioactive solid daughters attached to the mine dust was adhered to and practically applied in regard to the control of these occupational lung cancer hazards (Hueper) in the Rocky Mountain region of the Colorado Plateau, it should be pointed out that in more recent years the evidence on hand at the time and to an even greater and more convincing and conclusive degree hence contradicted definitely the scientific and rational validity of such peculiar conclusions.

Determinations of the radioactivity of the air in various mines in the Schneeberg region were made first by Ludwig and Lorenser; and Rajewsky. There were distinct fluctuations in the radioactive content of the air in different mines, in different parts of the same mine and in the same location in the same mine at different times. The water in the mines also contained radioactive material. The radioactivity in the mine air ranged, according to Ludwig and Lorenser, from 3.6×10^{-11} to 1.8×10^{-9} curies per liter. The highest values were obtained in places where the air was stagnant and, especially, at the head of the mine ducts where drilling was carried out and when thereby new pockets of radioactive gases were opened. The radioactivity at such places varied from 3.6×10^{-9} to 9×10^{-9} curies per liter. Rajewsky obtained in general, similar measurements (7×10^{-11} to 7×10^{-9} curies per liter) with the exception of values recorded for one mine (Siebenschlehen) known as the "Death Mine" because of the high incidence of lung cancer among the miners employed in this particular mine (Hueper). Rajewsky found here values up to 5.4×10^{-8} curies per liter. The springs in the mines exhibited a radioactivity similar to that found in the air. The air which the miners exhaled also was radioactive (Rajewsky; Lorenz). Lung tissue of fifteen miners who had died with cancer of the lung exhibited a degree of radioactivity which increased with age, ranging from 0.06×10^{-12} gm. radium equivalent per gram of fresh lung tissue to 2×10^{-12} radium equivalent. Lorenz pointed out that the data of Rajewsky indicated that the amounts of radon inhaled by miners during 18 years of work and 8 hours daily in the mine, and in part retained in the lungs, approached the lower limit of the toxic dose of inhaled radon (9.5×10^{-8} curies per liter of air). Rajewsky concluded from these findings — and Lorenz seemed to have accepted such a conclusion — that it cannot be denied that the damage produced by the inhalation of the air of the mines containing radon was one of the causes of the disease of Schneeberg. The evidence in fact is, however, much more significant because it is well established from experiences on man and experimental animals that the carcinogenic dose of a chemical agent is as a rule well below its minimal toxic dose. Neither Rajewsky nor Lorenz apparently were aware of this biologic principle which supports the view that the radon content of

the mine air is actually the predominant cause of the lung cancer in Schn miners — unless it is postulated that lung tissue is exceptionally resistant to th cancerogenic action of ionizing radiation.

The dose calculations mentioned suffer from an additional fallacy. The inha of radioactive aerosols results in an eminently non-homogeneous retention and d tion of solid particles on the bronchial mucosa. Such contacts, therefore, tend to through a localized preferential precipitation of radioactive particles on the bro mucosa, multiple circumscribed foci of high intensity radiation. Under these tions of exposure, a reliable and proper quantitative assessment of the focal rad dose received by the mucosa in relation to that required for the focal induction bronchogenic carcinoma cannot be made (Huc). Calculations of a minimal eff carcinogenic dose of inhaled radon and its solid daughters based on the concep homogeneous distribution and action of the inhaled carcinogenic matter on the bronchial mucosa thus are bound to yield distorted values.

c) Radioactive Lung Cancer Hazard in a Fluorspar Mining Community in Newfoundland

Epidemiology. Confirmatory epidemiologic evidence concerning a causal r ionizing radiation inhaled by miners employed in radioactive non-uranium was recently reported from Canada (de Villiers and Winnett; Parson Villiers, Bartelet and Beckelake). These mines were operated since 1933

Table 71. Expected and Observed Deaths Due to Malignant Neoplasm of the Trachea, chus, and Lung Among Male Underground and Surface Mine Workers at St. Law Newfoundland, 1932—1960 Inclusive[a]

Number of Deaths	All Ages	15–24	25–34	35–44	45–54	55–64	65–74
a) Death from all causes, Newfoundland, less death among St. Lawrence miners (1952–1960)	15,264	385	432	602	984	1,545	2,814
b) Death due to malignant neoplasm of trachea, bronchus, and lung, Newfoundland, less death due to this cause among St. Lawrence miners (1952–1960)	157	1	4	18	29	61	31
c) Death from all causes, St. Lawrence miners (1952–1960)	71		5	19	17	16	9
Expected death, St. Lawrence (b/a) × c	0.7303		0.0463	0.5681	0.5010	0.6317	0.0991
Observed death, St. Lawrence (1952–1960)	21		2	6	8	5	
Ratio of observed death to expected death	28.76		43.20	10.56	15.97	7.92	

[a] Cases in categories 1 to 3 only.

evidence recorded was related to the observation that since 1952 two to three de from primary cancer of the lung have occurred regularly each year among the inhabitants of a small fluorspar mining community of St. Lawrence, Newfoundl These deaths constituted 23 of the 51 deaths that occurred during the 10-year per

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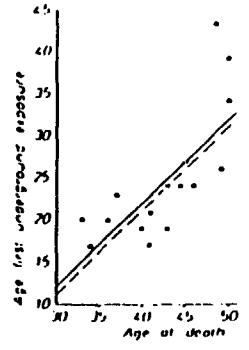
Table 72. *Comparison of St. Lawrence, Jachymov and Schneeberg, Colorado Plateau, and South Africa Data*

	Fluorspar Mines		Uranium Mines			
	St. Lawrence		Jachymov & Schneeberg		Colorado Plateau Working Mines	South Africa Working Mines
	Dead-end Areas	Ventilated Areas	Abandoned Mine	Working Mine		
Radon (pc per litre)						
Average	270—25,000[a]	< 5—1,510	7—54,000[b]	2,900[c]	70—59,000[d]	25—500[e]
Range				360—18,000[b]		
				7—7,000[b]		
Radon daughters (multiples of 1.3 × 10⁵ Mev per litre)						
Average	0.4—193	2.5—10[a,e]				
Range		0—12				
Gamma radiation (mr./hr)	0.03—0.50					
Incidence of lung cancer as % of miner deaths	33 (1933-61)		43 (1875—1939)[b]		11.4[d]	3.5[e]
	45 (1952—61)		52 (1921—39)[b]			
Duration of underground exposure (years) Average and range	12.5 (5.5—21.3)		17 (13—23)[b]		7, 8, 9, 10, 12	17.3 (3—30)[e]
Induction period (years)						
Average and range	19.1 (11.5—25.0)		25 (15—43)[b]			
Age at death (years)			50 (40—67)[b]			
Average and range	46.5 (33—50)		55 (37—69)[b]			55.2 (45—73)[e]

[a] Estimated, on basis of highest radon daughter concentration found. Estimated.
[b] Rajewsky (1939), quoted by Lorenz (1944); measurements made between 1926 and 1939.
[c] Evans and Goodman (1942).
[d] Ludewig and Lorenser (1924) quoted by Lorenz (1944).
[e] After Lorenz (1944).
[f] Nine cases — Pirchan and Sikl (1952).
[g] Thirteen cases — Rostoski and others (1926, quoted by Lorenz [illegible]
[h] Holaday et al. (1957); data collected in 1952.
[i] Miners with three or more years underground experience — [illegible] — Archer et al. (1962).
[j] Oosthuizen et al. (1958).
[k] Based on 14 of 23 cases reported by Oosthuizen et al. (1958).

(1952 - 1961) among employees with one or more years of undergro experience. A shift to a younger average age at death from lung car association between age at entry into risk and age at death were ob observed death rate from lung cancer of this population group was abo the expected one as determined by comparison with a control communit size in the same geographical region, and with the population of the r foundland. These epidemiologic findings were characteristic of an occupational exposure to a carcinogenic agent.

Table 73. *Relation Between Ag Occupation and Age at*



The following tables present the essential data on the lung cancer deaths among this miner population (Table 71 and 72) (de Villiers and Windish).

Etiology. The ore mined was fluorspar (calcium fluoride, CaF_2) which contained very small amounts of other minerals (0.002—0.4% of manganese; 0.002 - 0.01% of nickel; less than 0.01% of chromium; 0.27% of yttrium). Arsenic and cerium were absent. Minute amounts of radioactive samarium-147 were present. In addition to air-borne dust containing quartz and calcium fluoride, radon daughters were found in the mine air, as well as in the air of the processing plants (Table 73). These values were within the general range of those reported from the Schne Joachimsthal mines, considering the rather variable character in the amount active matter a different times.

While the evidence recorded points definitely to the radioactivity of th as the main factor causing the high incidence of carcinoma of the lung an fluorspar miners (Parsons et al.), it was deemed advisable to assess in t also the smoking habits of the miners because of the claims made by vario gators (Doll and Hill) concerning the major role of cigarette smoking of lung cancer. After citing the observation of Doll and Hill that lung 20 times as frequent among heavy smokers as among nonsmokers, the Ca vestigators noted that, "the 20 times greater incidence of carcinoma of the l Lawrence compared with the rest of Newfoundland might be considered a to smoking only if all the population of St. Lawrence smoked heavily (25 g of tobacco daily), while the population of the rest of Newfoundland w smokers. Since this is not the case, factors besides heavy smoking habits c Lawrence population must be operating to produce a high incidence of lu noma."

a) *Miscellaneous Non-Uranium Mines*

Metal Ore Miners of the Colorado Plateau. The recently published epidemiologic studies on the lung cancer frequency among uranium ore mi metal ore miners of the Colorado Plateau which were initiated by Hopper

CAPCO KIN 0000093

and after 1952, continued by the Division of Occupational Health, U.S. Public Health Service, and the Epidemiology Branch, National Cancer Institute, suggest that similar exposure conditions may account in toto or in part for the excessive frequency of pulmonary cancer among non-uranium metal miners of this region. The original epidemiologic investigations conducted on this subject by MILLER in cooperation with the Division of Industrial Medicine, University of Colorado (PRINCE and WARING; CHURCH) and the Colorado State Health Department (CLEBE; JACOE) between 1948 and 1952, demonstrated that the highest lung death cancer rates for males were present in the central section of the State where industrial and mining activities were prevalent (Fig. 45) and that lower rates were found in the eastern and western sections of this State.

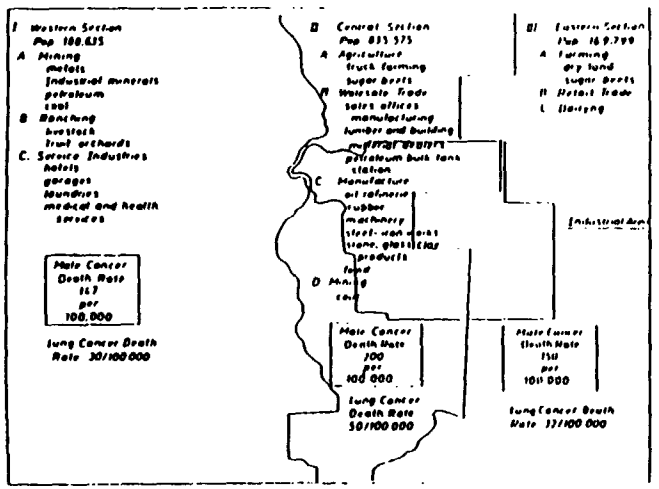


Fig. 45. Cancer death rates for males, 1943 to 1948, in three sections of Colorado

It is an established fact that many of the non-uranium mines in the Rocky Mountains are radioactive although usually only to a minor degree (JACOE). The metal mines studied by JACOE contained mainly gold, silver, lead, zinc and tungsten bearing ores. The highest concentration of radioactivity found was 2100 uuc/l and in only one location in a single lead mine no radon was found, however 30—60 uuc/l was found elsewhere in the same mine. A study of lead and zinc mines in a specific area gave such a variety of results that no relationship could be established. A group of these mines showed radon concentrations as follows: 119, 201, 151, 26, 126, 259, 1440 and 258 uuc/l, and a similar group in the same district — 160, 180, 310, 320, and 120 uuc/l. The next group in this area however showed only 0—60, 30, 50 uuc/l

This particular district has never produced uranium ores and is situated miles from the nearest uranium producing mine. In addition to a pollution underground mine air with radioactive matter, such mines usually are also mated with arsenic containing dust, since arsenic is present in most of the no metal ores. It is probable that the inhalation of this atmospheric pollutant significantly be involved in the causation of occupational lung cancers (W MILLER, LUNDIN, FRAUMENI and HAIJ) among non-uranium ore miners. The incidence of these tumors in this occupational group is evident from the data 74 (WAGONER *et al.*). This table, moreover, shows that in contrast to observa

Table 74. *Comparison of Foreign Born with Native-Born Metal Miners (Standardize Mortality Ratios, with Numbers of Expected and Observed Deaths According System, January 1, 1937, through December 31, 1959)*

Cause of Death	Foreign Born			Native Born		
	Expected Deaths	Observed Deaths	Standardized Mortality Ratios	Expected Deaths	Observed Deaths	S
All malignant neoplasms	41.9	78	186*	32.0	57	
Digestive system	19.8	39	197*	14.4	12	
Respiratory system	8.6	21	244*	7.5	26	
Other systems	13.5	18	133	10.1	19	

* Significant at 1% level ** Significant at 5% level

higher lung cancer rates in members of foreign born groups than in native native miners have a higher lung cancer rate than foreign born miners. The factor which may account for this excessive liability to lung cancer among miners in the Rocky Mountains region is arsenic.

In critically analyzing these observations, WAGONER *et al.* noted that histo cigarette smoking were not obtained in their study; however, it seemed to the likely that they would differ substantially from those of uranium miners (WAG ARCHER, CARROLL, HOLADAY and LAWRENCE). These differed from the g population only enough to raise the lung-cancer mortality by an estimated 10 cent. They stated, moreover, that it is unlikely that socioeconomic distribution account for the excess respiratory cancer rate in their study group, and tha genetic factors might not be suspected of having been operative.

The evidence on an excessive lung cancer frequency among radioactive uranium mines deserves global attention despite these uncertainties as to the a role which an atmospheric pollution of the mine air with radioactive matter play in this phenomenon, because the existence of similar radioactive air poll has been recorded for mines of several other countries and states (South Af Egypt; Germany; New York) (DE VILLIERS and WINDISH; HUBACHER; HA AWAAD, EL-SHERBINI, HAMMOND, HAZAA, KHARADLY and VALIC; CHEMICAL ENGINEERING NEWS). Such occupational exposures, however, have as yet not associated with any demonstrated excessive liability to pulmonary cancer by miners employed in such mines. Some studies have dealt with the influence wh radioactive mine air might have on the development of silicosis in the lungs of mi (ROSTOSKI; ULMER, NICOLAS, MUTH, OBERHAUSEN and ONSTEAD).

CAPCO KIN 0000094

β) Uranium Ore Miners

βα) Lung Cancer in Joachimsthal Miners

Epidemiology. Uranium ore mining was carried out until World War II mainly for extracting the radium contained in such ores, and less for obtaining the uranium to be used in the production of pigments, glazes, etc. During and after World War II, uranium ore mining was greatly expanded for the manufacture of military explosive devices and subsequently also for exploring the usefulness of nuclear energy for non-destructive, particularly commercial and medical — purposes. Uranium or carnotite or pitchblende mining is carried out in Bohemia, the Congo, Canada, the U.S.S.R., the United States of America, and various other countries. While the German investigators of the Schneeberg situation suspected for many years that the miners' disease known as "radium disease" and frequently observed among the pitchblende miners of Joachimsthal (Jachymov) — which lies 30 km. south of Schneeberg on the southern slope of the Erzgebirge — (Schmorl), was identical with the disorders affecting the Schneeberg miners, it was only in 1929 that Löwy substantiated this old supposition when he reported the first cases of lung cancer found in three (3) former uranium ore miners of Joachimsthal, in a radium plant with 60 employees. This first observation was followed by others in rapid succession (Sikl, 1930; Zill, 1930; Beutel, 1931; Pirchan and Sikl, 1932; Peller, 1939; Saupe, 1939; Teleky, 1937; Bensoussan and Fort, 1941; Mahler and Zill, 1930; Bensoussan, 1927; Waelsch, 1946). The mines at Joachimsthal employed in 1929 about 400 workers, of whom approximately 100 were miners (Löwy); 320 miners in addition to 80 pensioners were employed in 1931 (Sikl) in these mines.

Sikl reported in 1930 the presence of carcinomas of the lung in eight (8) out of 15 miners and pensioners who came to autopsy and estimated their incidence at 50% in all deaths in members of this occupational group. An additional case was published by Beutel in 1931. In a comprehensive report of Pirchan and Sikl appearing in 1932, nine (9) new cases of lung cancer in Joachimsthal miners were placed on record. They occurred among 323 miners during the years 1929—1930, and were seen among 19 deaths and in 13 necropsies. Saupe found in 1939 among 198 active or former miners subjected to a physical examination, three (3) cases of lung cancer. When in 1939, Peller reviewed the accumulated evidence, he established the following statistical correlations with lung cancer in Joachimsthal miners which are given in Table 75.

Table 75. *Cancer Mortality in Joachimsthal Miners per 1,000*

Cancer of	Joachimsthal Miners		Miners with Comparable Exposure 1912—1936
	1929—1938	1929—1938 Autopsies only	
Lung	9.8 ± 1.5	8.3 ± 1.6	0.34 ± 0.01
Larynx	0.2	0.3	0.07
Skin	0.2	0.3	0.05
Bone	0.2	0.3	0.12
All other organs	0.45 ± 0.3	0.0	3.86 ± 0.03
All organs	10.9 ± 1.6	9.2 ± 1.6	2.44 ± 0.01

Peller concluded from his epidemiologic studies that the miners of Joachimsthal have, 1. a high percentage of malignancies (53%) among their deaths; 2. a several-times-increased cancer mortality rate due to an enormous frequency of pul-

monary cancers in the age period 35—54; 3. an exceptionally high proportion of ... many lung cancers, 4. a reduced incidence of cancer in non-respiratory organs, 5. an increased mortality from causes other than cancer in younger age groups. ... noted, like Schmorl for lung cancers in Schneeberg miners, an increased incidence ... multiple primary tumors of the lungs among Joachimsthal miners.

In 1950, Sikl recorded a total of 20 cases of lung cancer in Joachimsthal mi... which had been observed between 1933 and 1938, and finally Waelsch noted ... 1946 that cancer of the lung accounted for the death of such miners in 45.4% ... total of 63 cases.

The distinct shift in the age at death from lung cancer among these miners is ... dent from the data collected by Gruehsmann *et al.* on this subject: 2 cases were ... the age 20—39 class; 11 cases in the 40—49 class; and 7 cases were in the 50 ... over class. The average age at death was given as 47.6 years, which agrees approx... mately with that noted by Sikl, which was 49 years. The exposure time varied f... 9 to 23 years and was given as 17 as an average. The lag period after cessation ... employment in the mines was up to 23 years. Among 26 cancers histologic... *examined, there were 10 squamous cell carcinomas and 15 round cell carcinomas* ... one case, the primary site was apparently not the lung, but the pleura and its ... was given by Pirchan and Sikl as undifferentiated atypical carcinoma. While s... degree of silicosis was seen in all lungs with cancer, silicosis on the whole was n... prominent feature in cases of cancer. In fact, lungs most heavily affected with ... cosis were generally free from malignant growth (Sikl; Pirchan and Sikl). Th... observations were in general agreement with those made in Schneeberg miners.

Pertinent to this problem of the role of silicosis and cancer of the lung in ra... active ore miners are the experimental observations of Watanabe and of Eng... brecht, Tuhart and Claassens. Watanabe exposing rodents to radioactive felds... dust, obtained a fibrosing pneumoconiosis, while this condition did not appear w... a non-radioactive feldspar was administered. Watanabe concluded from this ob... vation that the natural radioactivity of inhaled rock dust alone may cause the de... opment of fibrotic nodules in the lung. In the experiment of Engelbrecht *et* ... rats inhaled a radioactive silica-containing dust of gold mines for testing the pres... whether the radioactivity adds to the fibrosing effect of silica on the lung. ... investigators concluded that the radioactivity in the dust enhanced the fibrog... action of silica on the lungs of rats. Radiation cancers in other organs, especially ... hematopoietic organs and bones, were absent in Joachimsthal miners.

Etiology. The degree of atmospheric pollution with radioactive matter in ... Joachimsthal mines was stated to be 30 times the tolerance dose (Editorial; P... ler). It was noted that under such conditions of exposure it is scarcely surpris... that in the past, more than half of the miners died of lung cancer (Editorial, 19... This statement contrasts sharply with the allegation of Tschilenitz (1935) who ... died the physical conditions present in the mines in relation to the etiology of ... lung cancer. Tschilenitz claimed that it is grossly erroneous that radium introduc... into the body by drinking water or air, as found in Joachimsthal, can produce ... body injury. He pointed out in support of this astounding contention, that rad... inhaled is completely exhaled within 7 hours and that the work-free-interval of ... hours between shifts is completely sufficient to remove any permanent exposu... Tschilenitz nominated as the principal causal factor the injury to the struct...

CAPCO KIN 0000095

of the lung induced by the inhaled ores. Bergonié and Lacassagne, on the other hand, after a critical analysis of the exposure conditions present in the Joachimsthal mines came to the conclusion that the excessive incidence of lung cancer is attributable to the prolonged inhalation of radium emanation present in the mine air. The radioactivity of the air near drill holes was found to be up to 8×10^{-8} curies per liter. The activity of the springs in the mines ranged from 1×10^{-9} to 2×10^{-8}. The lung tissue of some miners contained 1×10^{-12} gm. of radium per gm. of tissue (Lorenz; Evans and Goodman).

The lung cancers in radioactive uranium miners of Joachimsthal, Czechoslovakia and in the radioactive ore miners of Schneeberg, Germany, have been accepted for many years past as occupational diseases to which compensation laws are applicable (Hueper; Löwy; Zeil; Official Report).

ββ) Lung Cancers in Uranium Ore Miners of the Colorado Plateau

Epidemiology. The initial attempt to obtain information on the probable existance of lung cancer hazards in uranium ore miners of the Colorado Plateau was organized by Hueper in 1948 with the cooperation of the Colorado State Health Department and the Division of Industrial Medicine, University of Colorado, School of Medicine, Denver, Colorado. It was planned at that time to ascertain the causes of death not only for uranium ore (carnotite) miners and millers, but also for workers engaged in the mining and milling of various arsenic containing non ferrous metal (silver, copper, zinc, etc.) ores — an activity carried on for many years in the same region. Because of administrative difficulties encountered in the continuation of this epidemiologic survey, it was appropriated in 1951 by the Division of Occupational Health, USPHS, which operated this exploration from then on in conjunction with the Colorado State Health Department and the Atomic Energy Committee.

These shifts in management of the epidemiologic survey in Colorado were brought about by the fact that at that time some Government scientists still believed that the lung was refractory to the carcinogenic action of inhaled radioactive matter and that for this reason, such exploratory studies were not indicated. These officials indeed went so far as claiming that scientists recommending such fact finding epidemiologic procedures in Colorado were displaying "bad scientific judgment" and deserved to be dismissed from the Government service (Hueper). They insisted, moreover, that any mentioning of the extensive experiences made since 1879 on occupational lung cancer hazards in Saxon and Bohemian radioactive mines at Schneeberg and Joachimsthal at medical conferences be suppressed as not being in the "public interest".

The mining of uranium ore on the Colorado Plateau had been a relatively small-scale operation until the latter part of World War II, when uranium ore became in great demand for the production of military explosive devices. The production of this ore rose rapidly after the war, and amounted for the year 1956 to approximately 3 million dry tons yielding one-fourth of one (1) per cent uranium concentrate or about 8000 tons by the end of 1956. In 1957, there were a total of 12 uranium mills operating in the United States. All except one were privately owned. The completion of construction of eight additional mills was scheduled for the end of 1957 or early 1958.

The uranium ore mining industry soon expanded from the Colorado Plateau into adjacent regions (Utah, Arizona, New Mexico, Montana, South Dakota and Wyoming) and employed a rapidly rising number of miners and millers. The study of the health hazards of this occupational group which was started in 1951 comprised about 5,400 miners and millers.

In addition to periodic medical examinations performed on the miners and millers, determinations of the quantity and quality of the ionizing radiations present in the various mines (in 1959 samples were examined of 302 out of a total of 371 mines which employed 3,619 miners) were made (Governors' Conference). When in 1961 a preliminary report on the results of these studies was rendered, it appeared that among 907 white miners with more than 3 years of underground experience, death from respiratory cancer (6 deaths) accounted for nearly five times the normal rate (Archer, Magnuson, Holaday and Lawrence). A cytological examination of the sputum of uranium miners started in 1957, provided additional evidence suggesting the existence of a radiation specific lung cancer hazard. In 1960, the sputums of 1,788 miners were examined. In the first 272 reports, the sputum of 230 miners was negative, that from 33 was doubtful, and that of nine (9), or 3.3 per cent, was positive for cancer cells.

The subsequent analysis of such correlations published by Wagoner, Archer, Carroll, Holaday and Lawrence in 1964 which covered an observation period extending from 1950 to 1962, yielded confirmatory evidence concerning an excessive liability of lung cancers in American uranium ore miners (Table 76).

Table 76. *Number of Expected and Observed Deaths from Respiratory Cancer in Relation to Duration of Underground Uranium and Underground Nonuranium Mining Experience (White Miners) 1950 Through 1962*

Duration of underground uranium and mining experience (years)	Duration of Underground Uranium Mining Experience					
	Less than 5 years		5 years or more		Total	
	Expected	Observed	Expected	Observed	Expected	Observed
0	0.7	0	0.6	5.4	1.3	5.1
1–4	0.3	0	0.1	0	0.4	0
5 and more	0.7	1	0.4	6.9	1.1	7.9
Total	1.7	1	1.1	11.9	2.8	12.9

[1] Significant at 5 percent level (B). [2] Significant at 1 percent level (B).

For testing the validity of their conclusion that the cumulative dose of airborne radiation contained within the uranium ore mines was responsible for the excess of respiratory cancers among the miners, Wagoner *et al.* calculated 3 measures of radon-daughter exposure for a number of miners (Table 77).

They found that the mean number of months of underground experience and the mean dose rate of miners with respiratory cancer were greater, though not significantly so, than those of other groups used for comparison. The value of these observations is accentuated by the fact that there was a significant excess of respiratory cancers even among uranium miners with no prior hard-rock mining experience.

Considering the fact that the uranium mines in the Rocky Mountain region are in operation for only a relatively short time, that the peak values of radioactivity in some of these mines were several-fold those noted in the "death mine" of Schneeberg, and that protective technologic measures, i.e., mainly ventilation, were introduced into the operation of most of these mines only after 1950 and did not invari-

CAPCO KIN 0000096

of the lung induced by the inhaled silica. Bronchitis and Lorey, on the other hand, after a critical analysis of the exposure conditions present in the Joachimsthal mines came to the conclusion that the excessive incidence of lung cancer is attributable to the prolonged inhalation of radium emanation present in the mine air. The radioactivity of the air near drill holes was found to be up to 8×10^{-6} curies per liter. The activity of the springs in the mines ranged from 1×10^{-9} to 2×10^{-8}. The lung tissue of some miners contained 1×10^{-12} gm. of radium per gm. of tissue (Lorey; Evans and Goodman).

The lung cancers in radioactive uranium miners of Joachimsthal, Czechoslovakia and in the radioactive ore miners of Schneeberg, Germany, have been accepted for many years past as occupational diseases to which compensation laws are applicable (Hueper; Löwy; Zill; Official Report).

ββ) Lung Cancers in Uranium Ore Miners of the Colorado Plateau

Epidemiology. The initial attempt to obtain information on the probable existance of lung cancer hazards in uranium ore miners of the Colorado Plateau was organized by Hueper in 1948 with the cooperation of the Colorado State Health Department and the Division of Industrial Medicine, University of Colorado, School of Medicine, Denver, Colorado. It was planned at that time to ascertain the causes of death not only for uranium ore (carnotite) miners and millers, but also for workers engaged in the mining and milling of various arsenic containing non ferrous metal (silver, copper, zinc, etc.) ores — an activity carried on for many years in the same region. Because of administrative difficulties encountered in the continuation of this epidemiologic survey, it was appropriated in 1951 by the Division of Occupational Health, USPHS, which operated this exploration from then on in connection with the Colorado State Health Department and the Atomic Energy Committee.

These shifts in management of the epidemiologic survey in Colorado were brought about by the fact that at that time some Government scientists still believed that the lung was refractory to the carcinogenic action of inhaled radioactive matter and that for this reason, such exploratory studies were not indicated. These officials indeed went so far as claiming that scientists recommending such fact finding epidemiologic procedures in Colorado were displaying "bad scientific judgment" and deserved to be dismissed from the Government service (Hueper). They insisted, moreover, that any mentioning of the extensive experiences made since 1879 on occupational lung cancer hazards in Saxon and Bohemian radioactive mines at Schneeberg and Joachimsthal at medical conferences be suppressed as not being in the "public interest".

The mining of uranium ore on the Colorado Plateau had been a relatively small-scale operation until the latter part of World War II, when uranium ore became in great demand for the production of military explosive devices. The production of this ore rose rapidly after the war, and amounted for the year 1956 to approximately 3 million dry tons yielding one-fourth of one (1) per cent uranium concentrate or about 8000 tons by the end of 1956. In 1957, there were a total of 12 uranium mills operating in the United States. All except one were privately owned. The completion of construction of eight additional mills was scheduled for the end of 1957 or early 1958.

The uranium ore mining industry soon expanded from the Colorado Plateau into adjacent regions (Utah, Arizona, New Mexico, Montana, South Dakota and Wyoming) and employed a rapidly rising number of miners and millers. The study of the health hazards of this occupational group which was started in 1951 comprised about 5,400 miners and millers.

In addition to periodic medical examinations performed on the miners and millers, determinations of the quantity and quality of the ionizing radiations present in the various mines (in 1959 samples were examined of 302 out of a total of 371 mines which employed 1,619 miners) were made (Governors' Conference). When in 1961 a preliminary report on the results of these studies was rendered, it appeared that among 907 white miners with more than 3 years of underground experience, death from respiratory cancer (6 deaths) accounted for nearly five times the normal rate (Archer, Malmstrom, Holaday and Lawrence). A cytological examination of the sputum of uranium miners started in 1957, provided additional evidence suggesting the existence of a radiation specific lung cancer hazard. In 1960, the sputums of 1,788 miners were examined. In the first 272 reports, the sputum of 230 miners was negative, that from 33 was doubtful, and that of nine (9), or 3.3 per cent, was positive for cancer cells.

The subsequent analysis of such correlations published by Wagoner, Archer, Carroll, Holaday and Lawrence in 1964 which covered an observation period extending from 1950 to 1962, yielded confirmatory evidence concerning an excessive liability of lung cancers in American uranium ore miners (Table 76).

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	Less than 5 years		5 years or more		Total	
	Expected	Observed	Expected	Observed	Expected	Observed
0	0.7	0	0.6	5[1]	1.3	5[1]
1–4	0.1	0	0.1	0	0.4	0
5 and more	0.7	1	0.6	6[2]	1.1	7[2]
Total	1.7	1	1.1	11[2]	2.8	12[2]

[1] Significant at 5 percent level (8). [2] Significant at 1 percent level (8).

For testing the validity of their conclusion that the cumulative dose of airborne radiation contained within the uranium ore mines was responsible for the excess of respiratory cancers among the miners, Wagoner *et al.* calculated 3 measures of radon-daughter exposure for a number of miners (Table 77).

They found that the mean number of months of underground experience and the mean dose rate of miners with respiratory cancer were greater, though not significantly so, than those of other groups used for comparison. The value of these observations is accentuated by the fact that there was a significant excess of respiratory cancers even among uranium miners with no prior hard-rock mining experience.

Considering the fact that the uranium mines in the Rocky Mountain region are in operation for only a relatively short time, that the peak values of radioactivity in some of these mines were several-fold those noted in the "death mine" of Schneeberg, and that protective technologic measures, i.e., mainly ventilation, were introduced into the operation of most of these mines only after 1950 and did not invari-

CAPCO KIN 0000097

ably produce a satisfactory improvement of the exposure conditions, it is safe to predict that many additional cases of lung cancer and a considerably higher incidence rate of these tumors will become apparent for this worker group during the decades to come.

Table 77. *Disease Classification of Uranium Miners According to Radon Daughter Exposure*

Disease classification	Number of miners	Mean age	Mean exposure: Under ground duration in months	Mean exposure: Dose rate[1]	Mean exposure: Cumulative dose[2]
1. Malignant neoplasms of the respiratory system	25	53.9	88.9	30.9	2,878.4 (X_1)
2. Respiratory diseases other than respiratory neoplasm (includes pneumoconiosis and conditions contributing to cor pulmonale)	24	53.5	74.9	22.6	1,826.2 (X_2)
3. Diseases other than those of the respiratory system (arteriosclerotic heart disease and "other neoplasms")	51	55.0	63.3	16.6	1,107.7 (X_3)
4. Living miners matched with respiratory neoplasms on basis of year of birth, year of initial examination, and exac	50	55.1	63.9	22.3	1,136.6 (X_4)

t value for $X_1 - X_4 = 1.19$ t value for $X_2 - X_4 = 2.04$[3]

t value for $X_1 - X_3 = 2.15$[3] t value for $X_2 - X_3 = 1.80$

[1] Average working level $= \sum_{i=1}^{m} \frac{X_i}{K}$

[2] Average working level months $= \sum_{i=1}^{m} \frac{X_i}{K} \times Y_i$

[3] Significant at 5 percent level-because of the multiple comparisons, i.e. 4 groups taken 2 at a time, the exact level of significance is unknown.

where
X = radon-daughter level.
Y = months of exposure at radon-daughter level.
K = $1.3 \cdot 10^5$ MeV of potential alpha energy from radon-daughter per liter of air
$i = 1, 2 \ldots m$ = number of radon-daughter level measurements.
n = number of miners.

Etiology. In etiologic respects it is important that Waldron *et al* stated that in contrast to the European uranium mines and to the U.S. metal mines, only minimal amounts of constituents of the ore suspected of carcinogenic activity in man (arsenic, chromium, nickel, iron) are present in the U.S. uranium ores. Their data showed, moreover, no relationship between the number of cigarettes smoked by these miners and the type and duration of uranium mining experience. They considered it, therefore, unlikely that smoking alone accounted for the excess of respiratory cancer among the long term uranium miners.

There is general agreement among several groups of investigators who determined the quality and quantity of ionizing radiation in 371 uranium ore mines of the Colorado Plateau and adjacent regions that in many of these mines the working level of radiation was excessive in many mines and in some highly excessive (Holaday *et al.*; Archer and Simpson; Governors' Conference; Thirey and Jacoe; Morris; Tsivoglou and Ayer; Miller, Holaday and Doyle). In 1959, thirty-three per cent of the samples taken of the mine atmosphere had concentrations of less than one time the accepted working level of tolerance; 22 per cent had between 1 and 3 times the working level; 23 per cent had between 3 and 9 times the working level, and 22 per cent had concentrations of more than 10 times the working level. The primary *hazard involved in mining uranium arises from the alpha emitters*, RaA, and RaC'.

While Neumann and Attacio, Welford and Morse proposed to use the amount of urinary uranium excreted in the Friday urine as a measure of exposure hazard, Sutzer and Hursh recommended that urinary polonium might serve as a rough measure to estimate the cumulative lung exposure to radon and its daughters. They mentioned in this connection that the radon daughters decay to lead[210], a lead isotope with a long effective half-life in the body and a decay scheme producing polonium[210]. Holaday *et al.*; Aurand *et al.*; Shapiro; and Jech devised methods for determining roughly the radioactive dose, i.e., radon decay products retained in the lung, from tests on exhaled air.

Because of the role which a radioactive type of lead assumes in determining these carcinogenic exposures of uranium ore miners, it may be mentioned that Black in 1943, raised the question of a possible lung cancer hazard for lead miners, smelter workers, lead solderers, plumbers, and members of many other occupations having contact with lead dust and fumes, because he observed lung cancers in two lead workers which developed many years after cessation of exposure to lead. Black pointed out in support of his claim that commercial lead contains radium D and is the most radioactive of all common metals. Its radioactivity was said to vary with the ore from which lead is obtained and with the age of the lead (Black). It is uncertain, however, whether this claim is valid since Dingwall-Fordyce and Lane reported in 1963 that lead workers seem to have a slightly substandard mortality rate from cancer of all sites. This renewed interest in a potential carcinogenic effect of lead on man was generated in part by the observation that lead fed to rats will cause carcinoma of the kidney (Zollinger; Rutland, Dukes, Griver and Mitchley; van Esch, van Genderen and Vink; Kehoe *et al.*). It is not likely that the excessive incidence of lung cancer among English boiler scalers is attributable to the 5 per cent of lead contained in the ash of the creosote-pitch fuel often used (Sherwood and Bloomer).

Information is lacking whether more than one of the American uranium ore miners who developed lung cancers have received compensation (McAdams), although the existence of causal relations to their job specific exposure to ionizing radiations is recognized (Ingram; Lisco).

No official data are available as to the occurrence of lung cancers among the uranium ore miners of Katanga, Canada, and the U.S.S.R. (Jacobs; Warschowski; Editorials).

CAPCO KIN 0000098

γ) Lung Cancer Hazards for Employees of Uranium Ore Refiners, Radium Laboratories, Nuclear Installations and Power Plants and Similar Establishments

Epidemiology. Individuals employed in uranium ore mills become exposed to fumes and dust of uranium, which is an alpha emitter. The radioactivity (alpha particles) of uranium presents its greatest hazard when the material is present as an insoluble compound, and lodges in the lungs for a long time (HARRIS and KINGSLEY). Uranium is the basic fuel of the nuclear reactors. It occurs naturally or artificially in various isotopes (U 233, U 234, U 235, U 238 and U 239). U 239 decays to plutonium 239. It has been claimed that so far no significant ill effects which could be attributed either to the chemical or radioactive toxicity of uranium have been seen in humans in personnel employed in nuclear energy installations (HARRIS and KINGSLEY). Whether the same holds true for workers employed in uranium refining plants, however, remains to be determined. Without any doubt such workers had at least ten years ago, definite and considerable exposure to uranium dust and fumes because of lack of any significant protective measures (HUEPER). The actuality of these conditions is well illustrated by pictures contained in an article by DOYLE. That metallic uranium when parenterally introduced into rats is capable of inducing cancers was shown by HUEPER, ZUEPLE, LINK and JOHNSON.

A similar absence of incriminating evidence concerning the presence of an occupational respiratory cancer hazard in nuclear reactor facilities is implied by reports published on this aspect although poor ventilation design in some such plants has been admitted (HELD). Emission of radioactive matter from the reactor stack causing atmospheric radioactive contamination resulting therefrom has been observed (LOWRY; GELLER, WORDEN, CASSIDY and BARTHOLOMEW). It is remarkable that LOVE in 1951 noted from a survey of an atomic pile site that a much higher than expected incidence of primary lung carcinoma prevailed at the Brookhaven National Laboratory. He claimed, however, that this phenomenon was not attributable to any occupational radiation exposure. MOSHMAN and HOLLAND made in 1949, a similar observation for the employees of the Oak Ridge installation and proposed that this finding merely reflected the normal trend in lung cancer rates.

Since at the time of the two reports all atomic energy installations had been operating for only a few years, it is unlikely that lung cancers among the employees of such establishments could justly be attributed to occupational factors at that time.

The respiratory radiation hazards related to such industrial activities resemble in many respects those associated with the burning of radioactive wastes in incinerators of institutions, laboratories, hospitals and related establishments and the operation of batteries of radioactive static eliminators (MACHIS and GEYER; COREY, PERRY and SCHWARTZ; BERMAN and ERNEST). Whether such atmospheric environmental pollution with radioactive wastes constitutes a respiratory cancer hazard to the neighborhood is likewise at present problematical.

Observations made in workers employed in radium factories and laboratories, on the other hand, strongly indicate that radioactive atmospheric pollutants (SAUPE; SCHLUNDT, MCGAVOCK and BROWN; MORRIS) inhaled by such employees represent the primary causal factor in the development of lung cancers as well as of leukemia in some of them. The occurrence of lung cancer in members of this occupational group was reported by LÖWY (2 cases — one of them having also leukemia); TELEKY (1 case); NEITZEL (1 case and 3 cases of pulmonary fibrosis (RAJEWSKY); STEIN (3 cases); BAADER, moreover, received information on four cases of occupational lung cancer in workers employed in Belgian radium ore refineries. It is obvious from this evidence that radioactive respiratory cancer hazards extend from the miners to the millers of uranium ores.

No information is available at this time whether the bathing in radioactive water practiced for the alleged protection and restoration of health in Germany, Bohemia and the U.S.A. and associated with an inhalation of radioactive mist and gas, constitutes an effective lung cancer hazard (LANGE; NEITZEL; SIKL; BEHOUNEK; HUECK) although the drinking of such water has caused in some individuals radiation sarcomas of the bone (HUEPER).

Fig. 46. Carcinoma of the maxillary paranasal sinus in a luminous dial painter (courtesy of Dr. Aub)

While the pulmonary cancer hazard related to the introduction of radioactive material into the lung is well known, considerably less attention has been given to the fact that occupationally inhaled radioactive chemicals or their direct injection for therapeutic or diagnostic purposes (thorium dioxide) into the paranasal sinuses also has been followed by the development of carcinomas of the paranasal sinuses. Such cancerous reactions have been observed in five former luminous dial painters (MARTLAND; AUB, EVANS, HEMPELMANN and MARTLAND; HASTERLIK, MILLER and FINKEL) (Figs. 46 and 47) as well as 5 patients receiving thorotrast injections into the maxillary sinus (HOFER; TULLIS; GROSS; FRUHLING and KEILING; BUDA, CONSLEY and RANKOW). The latent period of these radiation cancers which were squamous cell carcinomas, was from 15 to 20 years.

CAPCO KIN 0000099

A successful production of maxillary sinus carcinomas (squamous cell carcinomas) in rhesus monkeys which received intramaxillary implants of Ag^{110} and Co^{60} was reported by Melnikov. These observations demonstrate that various parts of the respiratory tract are capable of reacting with the development of cancers when adequately exposed to ionizing radiations.

The validity of this statement is further attested to by several observations on the occurrence of lung cancer in patients following a diagnostic parenteral injection of

Fig. 47. Squamous cell carcinoma of the maxillary sinus (three)

thorotrast (Fruhling, Gross, Batzenschlager and Dornier). Bronchial carcinomas have been seen many years after a bronchographic examination entailing an intrabronchial introduction of thorotrast by Rotte and by Virchow *et al*, while five additional such cases were reported after an angiographic use of thorotrast by Hackenthal; Abrahamson *et al*., Holthusen; Batzenschlager; and Nielsen and Kracht. Although there exists scarcely any doubt concerning the existence of causal interrelations for the two carcinomas developing after an intrabronchial introduction of thorium dioxide, such associations are less sure for the carcinomas of the lung following an intravascular injection of this agent. It must be pointed out, however, that reliable experimental evidence demonstrates that various colloidally dispersed particulate or macromolecular materials intravenously injected are retained in the capillaries of the lung. A part of such matter is subsequently excreted into the alveolar lumens enclosed in histiocytes (Huepper). This process has been observed also following intravenous injection of thorotrast. Since the decay of thorium dioxide is associated with the production of alpha-, beta-, and gamma-radiations the basic conditions exist in such cases for an ultimate development of pulmonary cancers.

Reports in the medical literature indicate that such cancerous responses to radiations have lately been observed also in other parts of the respiratory system, especially the larynx, in an appreciable number of patients who received some 20 to 40 years previously, x-ray treatments to the neck for malignant and non-malignant diseases, particularly those affecting the thyroid (Hoffmeier and Rabbeyt; King *et al*., Goodwin; Majoraus, Devine and Parrinell; van Nieuwenhuyse; Jacquin; von Lichtin; Garrelli).

A similar potential connotation is attached to the development of fibrosis of the lung following an occupational and, especially, a therapeutic exposure of the chest to large doses of x-radiation, emitted by radioactive chemicals as well as from x-ray tubes (Dolnicki; Imhofer; Tonges and Kalbfleisch; Belt; Warren and Gates; Warren; Hampert; Baudisch; Chu, Phillips, Nickson and McPhee; Fleming, Fuehs and Wehnle; Bauer and Schraer; Fatio and Goldberg; Bergmann and Graham; Loughlin and Maguire). In only one of these cases of chronic radiation pneumonia with fibrosis present in a worker inhaling radioactive industrial dust of a Fischer-Tropsch process did the histologic examination reveal an initial carcinoma after an exposure-free interval of 18 years (Imhofer). In none of the many hundreds of persons who developed this radiation pneumonitis after the administration of x-radiation for malignant conditions of the chest, especially carcinoma of the breast, on the other hand, has so far been seen a secondary cancerous development. It is not unlikely, however, that the great majority of these persons of usually adult age succumbed to their primary disease long before the latent period for radiation cancers of the lungs had elapsed.

Corresponding time relations may account likewise in part for the present absence of reliable observations on a causal relation between an inhalation of atmospheric radioactive pollutants and a delayed development of pulmonary cancers in members of populations most severely exposed to such carcinogen, since these usually act in a greatly reduced concentration, and, therefore, presumably require a much longer latent period for cancerous reactions to appear than that observed in uranium ore miners for cancer of the lung (mean value about 19 years) (Dunham; Medical Research Council, 1956; 1960; Eisenbud and Harley; Lochhart; Tajima and Dore; Carmichael and Tomnichelli; Sterbo and Coccoli; Setter; Zimmer, Lichtig and Tabor; Dawson; Hueper; Wicht; Pelletier and Whipple; Hollister). In assessing the potential carcinogenic significance of such exposures to the human lung, it must be emphasized that the absolute amounts entering the respiratory tract from such sources is very small when compared with the quantity of radioactive matter introduced into the lung from the various occupational activities cited. If such environmental radioactive atmospheric exposures should be effective in man, it must be supposed that because of the prospective very long latent period, only those individuals may develop some 40 to 50 years hence lung cancers who were in their early youth when being exposed. At the present, any incriminating claims represent for these reasons, mere speculations based on factually unfounded suppositions and dealing with possibilities. These, nevertheless, because of the general evidence available on such matters, deserve serious consideration.

CAPCO KIN 0000100

Experimental Carcinogenesis. The large amount of human evidence concerning a carcinogenic action of ionizing radiations on the tissues of the respiratory system has received lately ample support from experimental observations.

The production of cancers of the lung in experimental animals (mice, rats, dogs, rabbits) by radioactive chemicals, intratracheally, intrabronchially, intravenously or intrapulmonarily introduced has successfully been accomplished with a variety of such agents by an appreciable number of investigators (Warren and Gates,

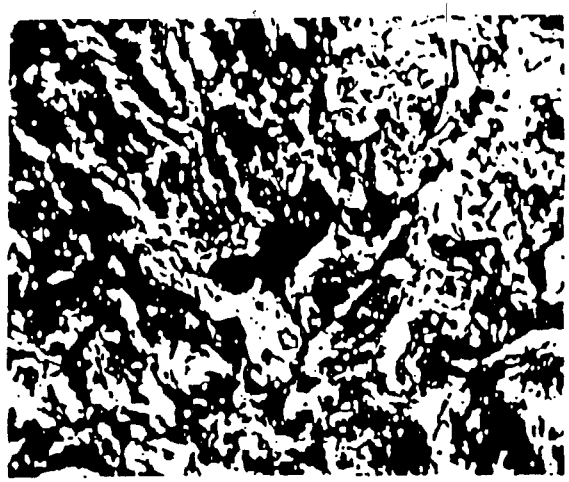

Fig. 48. Immature cell carcinoma in the lung of a rat intratracheally instilled with radioactive cerium (courtesy by Dr. Cosmo)

Willard, Marrs and Bair; Altmann, Hunstein and Stutz; Cember, Watson and Novak; Cember; Park, Bair and Clabel; Guimarães, Lamberton and Christensen; Cember and Stemmer; Kochetkova, Avrunina and Saladiak; Lasrin, Kuschner, Nelson, Altshuler, Harley and Daniels; Kotsetkova and Avrunina; Kuschner; Kurshakova and Ivanov). The following radioactive chemicals were used in these experiments: Cobalt^{60}; Strontium^{90}; Plutonium^{239}; Ruthenium^{106}; Yttrium^{90}; Cerium^{144}; Sulfur^{35}; Phosphorus^{32}; Gold^{198}; Iron^{59}; and Rhodium^{106}. The bronchial carcinomas produced were usually squamous cell carcinomas and undifferentiated carcinomas (Fig. 48). While these experiments provided ample proof of the fact that pulmonary tissue when exposed to various types of ionizing radiation, reacts with the development of bronchogenic carcinomas, they did not duplicate the type of exposure to radioactive matter present in man.

The results obtained when such chemicals were inhaled as a gas or dust must be considered of possessing more conclusive value.

In the first experiments of this type reported, Schinzinger failed to elicit any epithelial bronchial proliferations in experimental animals exposed to the inhalation

of dust of 6 drill holes from Schneeberg mines. Attempts of Rostoski and Saur reduce lung cancers in mice inhaling radium emanation (radon) were unsucces because of an early death of the mice. Dohnert, who exposed white mice to mine gases and dust by keeping them within the Schneeberg mines noted that a one year in the mines, seven (7) of the 26 mice histologically examined had mmary tumors (25%), of which two (2) were diagnosed as papillary adenocarc mas. Since some strains of white mice develop spontaneously lung adenomas much higher percentage of older animals, the significance of these findings is doub However, some support for suggesting causal relations between exposure and tumor formation may be deduced from the results obtained by Campbell exposed mice to the inhalation of dust from Joachimsthal mines and noted tumors of the lung were present in 20.3% of the test series, while they were foun only 2.1% of the untreated controls. Similarly positive observations were su quently reported by Rajewsky, Schraub and Kahlau and by Kahlau, who exp mice to the inhalation of radium emanation and noted the presence of many mmary adenomas and adenocarcinomas in these mice. However, the experime conditions used, particularly the employment of a non-inbred strain of mice a relatively small number of mice, impair the value of their observations. It mus mentioned, however, that experimental studies of Unnewehr on mice inha radon yielded similar neoplastic responses in the lung, i.e., the development of br chial carcinomas. Hueper and Lorenz, moreover, reported similar results when ani inhaled an aerosol of radioactive cerium (Ce^{144}).

Finally, it may briefly be mentioned that mice given either gamma radia emitted from radium or x-radiation over prolonged periods of time exhibited an creased number of pulmonary tumors (Lorenz, Eschenbrenner, Heuston Deringer; Lorenz, Heuston, Eschenbrenner and Deringer; Eschenbrenner Mueller; Lorenz, Heuston, Lorenz and Deringer). The results obtained in gui pigs and rabbits simultaneously and identically exposed to two types of radiati however, were equivocal.

12. Miscellaneous Respiratory Carcinogens

In addition to the different recognized or strongly suspected human respirat carcinogens of occupational and/or environmental significance, there exists a gr of chemicals which either have shown such properties when introduced into exp mental animals only and for which so far any corresponding experience in man lacking — although man becomes, for various reasons, exposed to these agents — have exhibited carcinogenic qualities for other organs in experimental animals, wh a few isolated observations in man suggest that they may elicit cancers of the res ratory tract in this species. The evidence on these chemicals is presented so as to al all interested parties in such potential relationships, to stimulate intensified study these chemicals, and to provide whatever basic information is available on the ca cinogenic action of these chemicals which may be valuable for any medicolegal pu poses. The observations cited, though representing mere clues of possible respirato cancer hazards, are nevertheless important since the discovery of the majority of presently known occupational cancers has resulted from further studies of such fi mentous evidence.

CAPCO KIN 0000101

a) Isonicotinic Acid Hydrazide (Isoniacid)

During the first decades of this century, tuberculous scars of the lung were regarded by many investigators as a cause of pulmonary cancer developing on the basis of a derailment of regenerative processes in the adjacent lung tissue (Huebner). This concept became distinctly less popular after 1930 following the discovery of specific chemical carcinogens and with improvements in the epidemiologic-statistical methods of analysis. During the past decade, however, a definite revival in the scientific interest of causal connections between pulmonary tuberculosis and lung cancer has occurred. In fact, the concept of a scar cancer of the lung has again found wider acceptance (Roessle; Carroll). Roessle proposed that cancer formation at such sites was attributable to the carcinogenic action of the accumulated cholesterol.

Balo has reported, moreover, on the development of atypical epithelial proliferations and of lung cancers in the marginal areas of old infarcts, while Pansa and Mollo have observed similar abnormal epithelial growth in the lungs of rabbits following the experimental production of hemorrhagic infarcts. These lesions were suggestive in their morphologic characteristics of early carcinomatous changes.

Recent experimental findings of Stanton and Blackwell have thrown additional light on the possible causal mechanism operating in the development of the so-called "scar" cancers of the human lung. These investigators injected intravenously into rats a mixture of a halogenated hydrocarbon (hexachlorotetrafluorobutane), which causes the development of multiple infarcts in the lung, together with a carcinogenic hydrocarbon (methyl-cholanthrene) and observed invasive epidermoid carcinomas derived from regenerating epithelium in the periphery of such infarcts. If methyl-cholanthrene was given in tricaprylin which does not produce infarcts, the development of massive keratinized cysts in the lungs only were obtained which, however, did not become cancerous. While Stanton *et al.* assumed that the regenerative epithelial proliferation elicited by the process of infarction played an important role in determining the cancerous sequelae induced, it is more likely that the infarcts with their interrupted vascular supply served as localizing and concentrating mechanisms for the carcinogenic chemical and that thus the carcinogenic effects associated with infarction reflect actually a quantitative dose phenomenon affecting circumscribed parts of the lung. The histologic observation made by Heuper on the preferential accumulation of oil droplets around scars, tubercles, bronchopneumonic foci, and similar areas with interrupted blood supply and blocked vascular lumens of the pulmonary system of man following an intravenous injection of camphorated oil strongly suggests this action mechanism. The lack of cancerous transformation of the frequently occurring squamous-cell metaplasias with cyst formation in the lung of old rats with chronic pneumonic conditions, on the other hand, attest to the fact that squamous-cell metaplasia of the bronchial epithelium as such is not necessarily a precancerous condition.

Associated with this recent change in the reaction toward the existence of causal relations between pulmonary subpleural scarring and the subsequent development of lung cancer has been the appearance of numerous reports on the frequency of coexistence of pulmonary tuberculosis and cancer and on the suspected causal relations between the two conditions (Crinquette and Hamel; Gehle, Feyfeld, Fuhrmann and Sparger; Bodenstab and Quarz; Wolford, Webb and Stauss; Southway; Kimpfels, Hermann and Helm). Tonutti, however, has recently challenged the validity

of such claims by pointing out that the so-called scars are pleural depressions preexisting to the tumor but caused by it. They, moreover, do not correspond to previous infarcts, are not tubercular and occur mostly in persons 40 to 50 years

Despite these criticisms of Tonutti it may nevertheless be possible that the increased interest in the association between pulmonary tuberculosis and cancer is at least in part, a real and recent change in the therapeutic management of pulmonary tuberculosis which is related to the introduction of chemical tuberculostatic agents, especially isonicotinic acid hydrazide (isoniacid).

Experimental observations made by several investigators during the past few years have shown that isoniacid is a chemical carcinogen to mice in which it is capable of producing benign and malignant tumors of the lung as well as cancers in other organs (Juhasz, Balo and Kennedy Vialetta and Casamova; Schwan, Mori, Yasuno, Matsumoto; Bianchedi and Ribaccini). Fukui, Niigata, Imamura and Tagawa have drawn attention to the fact that, according to Mori *et al.*, compounds capable of inducing pulmonary tumors in mice (isonicotinic acid hydrazine, ethyl carbazate, semicarbazid, pyrazinamide) have a remarkable similarity of their molecular structure in containing a carbamyl group ($NH_2-\overset{\overset{O}{\|}}{C}-$).

While it is possible that the two developments cited are merely chronologically related, the fact that the tuberculostatic chemical, isoniacid, is a pulmonary carcinogen nevertheless suggests that there might exist a causal relation between these events, and that the therapeutic use of isoniacid in patients with tuberculosis of the lung may have played an active and essential part in the subsequent development of pulmonary cancer in some of them. The evidence on hand in support of such a hypothesis deserves to be tested for its validity through conducting a critical analysis of all cases of lung cancer in tuberculous individuals whether or not they had been treated with isoniacid or any other tuberculostatic chemical and whether the quality and quantity of the chemical used as well as the latent period and any other circumstantial evidence point to the existence of a relation between the treatment given and the following pulmonary carcinogenesis.

The potential occupation significance of these experimental observations is suggested by the fact that hydrazines are employed as rocket propellants and oxidizers in the production of which the carcinogenically highly potent nitrosamines are formed (Boyson).

b) Nitrosamines

Nitrosamines are compounds frequently used in or generated during chemical processes of industrial importance since nitrosamines are formed when dialkylamines are acted upon by nitrous oxide or nitric acid (Druckrey, Preussmann and Schmähl). The rocket propellant, dimethylhydrazine, thus is a reduced derivative of dimethylnitrosamine (Boyson; Argus, Leutze and Kahn; Argus and Hoch-Ligeti). While so far no human observations are on record indicating that any one of the various nitrosamines found to be carcinogenic for mice, rats, guinea pigs and hamsters exerts a similar action on man, Druckrey has suggested that such chemicals might be contained in cigarette smoke and thus account for some of the carcinogenic properties exhibited in animals by cigarette tar.

CAPCO KIN 0000102

The following experimental observations demonstrate the high carcinogenic potency of nitrosamines and specifically their carcinogenic action on the trachea, bronchi and alveolar structures of the lungs and nasal sinuses of animals (Druckrey, Preussmann and Schmähl; Schmähl; Schmähl and Druckrey; Dontenwill and Mohr, Argus and Hoch-Ligeti; Druckrey, Preussmann, Schmähl and Müller, Schmähl and Magee; Druckrey and Preussmann; Zak, Heilner, Singer and Porter; Dontenwill, Mohr and Zagel; Herrold and Dunham).

Although the various nitrosamines differ among each other in their organotropic carcinogenic action (liver, stomach, esophagus, trachea, lung, kidney, bladder, brain) depending upon their chemical constitution and the particular species used, many of them induce the development of squamous cell carcinomas and adenocarcinomas of the trachea and bronchi and alveolar carcinomas of the lung (dimethylnitrosamine, diethylnitrosamine, N-N-diamylnitrosamine, N-nitrosopiperidin, N-nitrosomorpholin, N-nitroso-N-methyl-urethane). The relatively high cancer attack rates, the remarkable organ specificity of some of these chemicals and the organic and species pluripotentiality of some members of this group of chemical compounds indicate their potential importance as possible human carcinogens. The experimental observations on hand are sufficiently serious and adequate for justifying thorough investigations of occupational and general population groups specifically exposed to these chemicals or their reduction and oxidation products. While the reduction product, dimethyl hydrazine, has proved to be noncarcinogenic, the oxidation product, dimethylnitramin, when fed to rats has produced kidney cancers.

c) Nitroquinolines and Related Nitro- and Amino Compounds

Another potential human respiratory carcinogen is 4-nitroquinoline 1-oxide, which was developed as a fungicide (Uri, Bognar and Beres; Nakahara). This chemical and some of its nitro- and aminoderivatives induce when applied to the skin, squamous cell carcinomas, and sarcomas when injected subcutaneously into mice and rats (Takayama; Shirasu and Oota; Shirasu; Nakahara and Furuma; Nakahara, Fukuoka and Sakai; Endo and Kumé; Chino; Lacassagne, Buu-Hoi and Zajdela). Subsequent studies yielded the fact that mice subcutaneously injected with this chemical developed also benign and malignant epithelial tumors (adenocarcinomas) of the lung (Mori; Mori and Yasuno). It is noteworthy that similar neoplastic responses in the lungs were evoked in mice when they were painted, with, or inhaled para-benzoquinone (Hayashi, Kanizawa and Ide; Tarizawa; Tarizawa and Kanizawa; Kishizawa).

The administration of acetylaminofluorene to rats, but not to hamsters, has also resulted in the development of bronchial carcinomas (Bielschowsky; Dontenwill, Mohr and Zagel), and N,N'-2,7-fluorenylenebisacetamide has been shown to induce cancers of the lung in rats in addition to cancers of the liver, mammary glands, glandular stomach, jejunum, ear duct, uterus, skin, salivary glands, kidney, cranial nerves, adrenal cortex pancreas and hematopoietic tissues (Murray; Wagner; Ray, Stewart and Snell). A comprehensive experimental and epidemiologic investigation of aromatic and aliphatic amino- and nitro-compounds for carcinogenic properties exerted on tissues of the respiratory system of man and animals is urgently needed as a part of the general study on the etiologic factors responsible for the causation and rise in frequency of cancers of the lung in man. Such investigations are

especially indicated for the large group of aromatic amino- and nitro-aben workers, because Ulrich and Pleischer noted not only an excessive incidenc bladder cancer but also of lung cancer among Swiss benzidine workers.

d) Carbamates

The cancerigenic action on various tissues, especially the lungs of mice and rats ethyl carbamate (urethane) and the demonstration of this effect in the offspring mice which received urethane during the last stage of pregnancy (Nettleship Henshaw; Larsen and Heston; Larsen; Haddow and Sexton; Schlotmann Lutz-Ditmars; Rieppi; Mostofi and Larsen; Berenblum and Haran-Ghe Klein; Jaffe; Guyer and Claus; Rosin; etc.), has given rise to speculations whet or not the use of urethane and other carbamates in medicine and in the various d micals widely employed as pesticides, insect repellents, and herbicides (Ball a Cowin; Bartalini; Shabad and Naumova; Esrola; Kyle, Schwartz, Oliner a Dameshek; Cramer) might have played a role in the rise of lung cancers duri recent decades (Baltz). This suspicion received lately some support by the fact th ethyl carbamate and isopropyl n-phenyl carbamate (van Esch, van Genderen a Vink) were shown to be carcinogenic initiators and capable of producing cancers the skin, liver and other internal organs of mice (Tannenbaum). A weaker neopl tic effect upon the mouse lung was demonstrated for several closely related carb mates (propyl carbamate; N-methylethylcarbamate; N-hydroxy-ethylcarbama (Fukui, Nagata, Imamura and Tagashira). The production and use of polyuretha plastics in the human economy have recently created another source of widespre contact of occupational and general population groups to polymerized carbama derivatives which have been found to be carcinogenic when implanted into ra (Hueper and Payne). The incriminating experimental evidence on hand is suff ciently serious for justifying the following investigations:

1. Surveys on the occurrence and incidence of cancers of the respiratory systen especially the lung, should be conducted among producers and users of carbama pharmaceuticals, pesticides, herbicides and insect repellents for establishing factua evidence on the neoplastic action of such compounds in man.

2. Similar epidemiologic surveys should be made on worker groups engaged in the production and processing of polyurethane plastics especially where fumes and dust from such products are inhaled.

e) Chlorinated Hydrocarbons

Chlorinated hydrocarbons are mainly known for their toxic effect upon the liver in man and animals and for their hepatocarcinogenic action in mice, rats and hamsters (chloroform, carbon tetrachloride, DDT, Aldrin, Dieldrin, Aramite) (Edwards and Dalton; Della Porta, Terracini and Shubik; Rudali and Mariani; Eschenbrenner and Miller; Stowell, Lee, Tsubiri and Varkasava; Fitzhugh and Nelson; Davis and Fitzhugh). An our Lan, moreover, has recently demonstrated that DDT, methoxychlor, Rothane (dichloro-diphenyl-dichlorethane) and Kelthane (Di-p-diphenyl trichlor-ethanol) like the carbamate insecticide, Sevin (1-naphthyl-N-methyl-carbamate), when applied to the invertebrate, Turbellaria or Tricladida, elicit abnormal cell growth of the epidermis and tumor formation.

CAPCO KIN 0000103

The observation of a cancer of the lung in a laboratory technician, 21 years old, who had worked with DDT for nine years previously (Randig) and in a chemist-entomologist who had been engaged for a number of years in the development of DDT preparations (Hueper) suggest the possibility that these hepatocarcinogenic agents when inhaled in sufficient quantities over an adequate length of time might exert also a carcinogenic effect upon the respiratory organs. For this reason, it seems to be advisable to undertake epidemiologic studies on producers and the industrial and agricultural users of chlorinated hydrocarbons inhaling these chemicals in the form of dust, mists, suspensions and gases sustaining identical types of exposure for their relative liability to cancer of the respiratory organs.

f) Formaldehyde

Since formaldehyde is a mutagen (Auerbach) and because Garschin and Schabad (1935) produced atypical proliferations of the bronchial epithelium in mice following the introduction of formalin, the suspicion has prevailed that the inhalation of formaldehyde vapors might lead to the development of lung cancer in man (bakelite makers, undertakers, histologic technicians, wrinkle proofers of clothing, etc.) (Fisher, Kanof and Biondi; Glass; Henson; Lutz; Bourne and Steerman). Some experimental support of such a suspicion may be deduced from observations of Watanabe and Sugimoto, who obtained subcutaneous sarcomas in rats following the subcutaneous injection of urotropin, a formaldehyde releasing urinary antiseptic. Experiments of Horton, Tye and Stemmer who subjected mice to the inhalation of gaseous formaldehyde, did not result in the production of pulmonary tumors although the tracheal and bronchial mucosa of such animals showed hyperplastic and atypical metaplastic changes which, however, did not progress to an invasive cancer. In contrast, some of the mice subjected to repeated inhalation of an aerosol of coal tar developed squamous cell cancers of the bronchi. Formaldehyde vapors applied simultaneously with the inhalation of aerosol of coal tar did not hasten or potentiate tumor formation in the lung.

There is not sufficient experimental and human epidemiologic evidence indicating that exposures to formaldehyde vapors constitute a significant and actual lung cancer hazard.

g) Natural and Man-Made Polymers

Several isolated observations suggest that an occupational and habitual inhalation of various natural and man-made carbon polymers might causally be related to the development of cancer of the lungs. The coexistence of bagassosis and lung cancer was reported by Onuigbo. Kotin and Falk recorded two cases of lung cancer in workers exposed to fiberglass and plexiglass dust or fumes generated during the synthesis and manufacture of these products. Fragments of the polymers were present in the tumor tissue. Breslow, studying the role of different occupational factors in pulmonary carcinogenesis, found that deep-fat frying cooks had a statistically excessive liability to lung cancer. It may be of significance that fatty acids undergo polymerization when subjected to high temperature and oxidation and that such fats contained material which when injected into rats displayed carcinogenic properties. The demonstration of carcinogenic qualities in various aliphatic diepoxides when applied to the skin of mice furnishes additional evidence that polymerization products might be

involved in the cancerization process elicited by some chemicals since diepoxi exhibit a tendency to polymerize and to influence the degree of polymerization chemicals with which they come in contact (Hendry, Homer, Rose and Walpo Weil, Condra, Haun and Striegel; Orris, van Duuren and Nelson; Hine, G man, Coursey, Wellington and Anderson; Kotin and Falk). Since Hine et found in tests on animals that two epoxy-resins possessed carcinogenic properties, may be pertinent to point to the excessive attack rate of lung cancer in paint (Piper; Wynder). Mention also may be made in this connection of the local a systemic carcinogenic effects elicited in rats by parenterally introduced carboxyn thyl cellulose, polyvinyl pyrrolidone and several dextrans (Nelson; Hueper), si these and similar water-soluble polymers are widely used as active ingredients in h lacquers and have induced in some individuals (beauticians especially) multifo granulomatous reactions in the lungs (Edelston; Bergmann, Flance, Cruz, Kl Aronson, Joshi, and Blumenthal; Brunner, Giovacchini, Wyatt, Dunlap a Calandra; Bergmann; Brunner; Draize, Nelson, Newburger and Kelly; De Doyle; Cares).

1. The spreading practice of deep-fat frying for commercial and home purpo and the thereby conditioned exposure of cooks, kitchen personnel and housewives fumes and mists of repeatedly heated and oxidized fats which have undergone pol merization, provides an urgent indication to survey employees of commercial deep-f frying operations for their relative liability to cancers of the respiratory organs.

This type of respiratory exposure may also be present as a part of the carcin genic hazards connected with charcoal broiling of meats and fish, although the maj part of carcinogenic exposures is probably connected here with the inhalation of ca cinogenic combustion products of coal or wood and of burned meat and fish.

2. Employees in beauty parlors and women and men applying frequently to the hair and without precautions, nebulized hair lacquers furnish another group of peop in need of comprehensive and critical epidemiologic analysis for occupational a habitual lung cancer hazards.

3. A third class of individuals who should be analyzed in this direction are t large and diverse groups of industrial producers, processers, and users of wate soluble and insoluble, solid and liquid plastics inhaling dusts, fumes, and mists various natural and man-made polymers and developing in part as the result of su exposures, irritations of the lung (chemical pneumonia) or pneumoconioses.

D. Prevention and Control of Occupational Respiratory Cancer Hazards

The evidence presented establishes definitely the fact that numerous man-mad and man used respiratory carcinogens have been introduced into the human environ ment during the past 150 years and that they are responsible not only for a rapidly growing number of occupational cancers of the lung, pleura, larynx, nasal cavity and paranasal sinuses, but evidently also play a significant role in the causation of such cancers in the general population through their direct or indirect, local and general

CAPCO KIN 0000104

spread into the atmosphere, especially of urban and industrialized regions. Since cancers of the respiratory system are still among the least successfully controlled malignant tumors and have alarmingly increased in frequency during the last 60 years, they represent an important problem for applied cancer prevention.

A practical approach to occupational respiratory cancer control by preventive and prophylactic measures has to include two aspects representing different problems of technology, public health, and law. The primary, but not always principal hazard affects the various types of workers engaged in the production, processing, handling, transportation, shipping, consuming and using of such carcinogenic materials. It is obvious that this group of workers includes often a considerable number of individuals who are not ordinarily and readily suspected of having such contacts. Many of them, moreover, are being exposed to such agents while working either on other jobs within the plant area or while handling such products, usually intermittently, in transit (stevedores, truckers, shipping clerks, laundresses, salesmen, delivery men, etc.). There can be little doubt that under ordinary circumstances, occupational exposures to respiratory carcinogens go often unnoticed for the last group of individuals listed. They are usually also not subjected to any control measures. Cancers resulting from such contacts for these reasons do, as a rule, not become causes of compensation procedures even if existing occupational compensation laws would apply to occupational diseases contracted under such circumstances.

The second and often much larger group of individuals exposed to occupational or industrial respiratory carcinogens, comprises the persons who have contact with these agents following their dissemination in the immediate environment of industrial establishments (fume zone), i.e., persons who work, live, play or attend school near such plants and later in life and often after a lag period of many years, develop the so-called "neighborhood cancers". A variety of these cancers are represented by those which occur in individuals living or working near the roads of transportation of carcinogenic materials and inhale, therefore, the dust from roads accidentally contaminated with such materials or reside along roads paved with slags containing carcinogenic residues (asbestos, radioactive chemicals, nickel, etc.) An additional group of persons having environmental exposures to respiratory carcinogens consists of members of the household of workers who have occupational contact to carcinogens and who bring home their dusty and dirty work clothes for cleaning, and thereby spread contact with such carcinogens to other members of the household ("household cancers"). The definite demonstration of such respiratory "neighborhood" and "household cancers" is of rather recent date and has remained limited essentially to only two types of carcinogen (beryllium, asbestos). Their recognition was facilitated by the fact that these carcinogens produce pulmonary changes of etiologically characteristic nature. While the environmental dissemination of respiratory carcinogens has been made the subject of some control legislation, it is doubtful whether any number of these cancers appearing in members of the general population from such events has ever been made the subject of litigation or of criminal prosecution.

A preventive control of occupational respiratory cancer hazards can be achieved by either eliminating the carcinogenic agent from the work environment, i.e., by discontinuing its further production and use, or by employing production and handling procedures which preclude any contact of workers with the hazardous material. The practical application of the first mentioned method of control which obviously is

the most effective one, encounters often distinct difficulties because of the una able need for many of the carcinogenic products mentioned, such as chromium, n carbonaceous fuel, etc. It is, moreover, obvious that such procedures would al result also in the closure of the plant and thereby in the loss of employment o workers involved. Safety, therefore, is bought under such circumstances with u ployment through elimination of the hazardous jobs.

A similar result is likely to occur in many instances if hazardous occupat exposures to respiratory carcinogens are controlled by the introduction of safer more effective technologic production measures. Such procedures usually are ciated with the introduction of extensive automation which again results in a re tion in labor force. The use of and insistence on technologic preventive mea against respiratory cancer hazards, as against any other industrial cancer haz thus create serious social and economic repercussions for the workers employe such operations. The safety obtained under such circumstances for the worker tained in their jobs is, moreover, rarely absolute. There usually remains some avoidable degree of hazard for such workers. Unless special precautions are take is also possible that the use of effective preventive measures within a plant may re in a more marked pollution of the periplant environment, i.e., air, soil and wa through a more massive release of plant wastes with exhaust air and waste water is obvious from these considerations that also a control of respiratory cancer haza by technologic means is available only for a price. It is up to human society to dec whether or not it is willing and able to pay the entire price or whether it prefers make a compromise at some level of partial safety which does not endanger its p sent economic existence, but which at the same time provides only incomplete a probably not maximally possible safety.

It is apparent, moreover, from the preceding discussion that in any attempt secure relative protection against occupational and industry-related respiratory ca cer hazards, human society is faced with the practical and moral problem that s efforts might result in the substitution of one social inequity by another one and th the enforcement of justice thereby might become a two-faced measure. Any attem at improving radically this complex situation and to unravel the complicated rel tionships will confront mankind with the perplexing dilemma of finding new mea for promoting progress and prosperity without human sacrifice and for restrainin those of its members who continue to adhere to the old principle of dubious morali that the ultimate purpose of organized mankind is the accumulation of physic monetary assets and not the acquisition of moral values and the protection of th well-being of its individual members as well as of mankind as whole.

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Exclusive of Silicosis

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CAPCO KIN 0000121

Scar cancer, lung 1, 3, 6
Schneeberg miners, lung cancer 127
Shale oils 118
Shellac pneumoconiosis 6, 7
Siderosis 98
Siderosis, lung idiopathic 94, 97
— — occupational 94
Silastic 39
Silicones 39
Silicosis 2—6
—, anticancerous effect 4
—, hematite miners 4
—, Schneeberg miners 4
Smudge pots 125
Soot 8, 9, 10
Tabacosis 6
Tobacco contaminants 6, 12
— Dust 6
Trauma, lung cancer 2
Uranium economy 108
— ore miners 136—141
Urethane 10, 11
Water pollutants 31, 143
War prisoners, scrotal cancers 119
X-Radiation, lung cancer 125
Yperite see Mustard gas 101

Monographs already published

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CAPCO KIN 0000122

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DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE

NATIONAL CENTER FOR
AND INDUSTRIAL HEALTH
EAST CENTRAL FRANKLIN
CINCINNATI, OHIO 45202

REFER TO:

December 7, 1967

Johns-Manville Company
22 East 40th Street
New York, New York 10016

Gentlemen:

We have had an inquiry from a local health officer about the carcinogenic effect of asbestos from A-C pipe in drinking water.

We will decide about the effects of ingested asbestos, but would like to know if you have any data about the amount of asbestos that might occur in drinking water. How much is introduced during pipe repairs and tapping? Does solution of the calcium out of the cement into the water release asbestos fiber? Do you know anything about a report "-that near Memphis, Tennessee, there was a period in one locality where the pH in the water was 10 or 11 and this resulted in a solution in the cement component of the pipes to such an extent that the water became milky-" that we have been asked about.

I will appreciate your comments on this problem.

Sincerely yours,

Leland J. McCabe
Chief, Disease Studies
Water Supply and Sea Resources
Program

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PNEUMOCONIOSIS RESEARCH UNIT

Visit by Medical and Science Correspondents
Wednesday, 22nd February, 1967

ASBESTOS AND CANCER

It is now accepted that there is an association between exposure to asbestos dust and the development of certain cancers. These are cancers of the lung and mesotheliomas of the pleura and peritoneum. There is evidence that there is an increased incidence of cancers of the gastro-intestinal tract; this has been produced by German and American investigators. The cancers of the lung occur in workers with severe asbestosis - fibrosis of the lung due to asbestos dust. In contrast to this the mesotheliomas can occur in people with minimal fibrosis and, in some cases, asbestos is found in the lungs but insufficient to cause any scarring of the lung tissue. In these people the exposure to asbestos dust is relatively slight, and may be as little as three months. In some cases, the exposure has been environmental, not occupational. The time between the exposure and the development of the tumour is usually more than thirty years. These diseases are due to the inhalation of asbestos dust. There is no known danger through drinking water from asbestos pipes, or beer that has passed through asbestos filters.

Asbestos is a generic term applied to a number of fibrous silicates. Four types of this material are, and have been, used commercially in Britain. These are chrysotile, crocidolite, amosite and anthophyllite. Chrysotile is by far the commonest type, the total world annual production being more than 3,000,000 tons; the main sources are the Soviet Union, Canada, South Africa, and Cyprus. Crocidolite (blue asbestos) is mined in South Africa and until recently in Western Australia - the annual production is about 150,000 tons; the amount imported into Britain has been reduced in recent years, and is now 7,500 tons. Amosite is found only in South Africa where 100,000 tons are produced annually, the use of this fibre is increasing in Britain and about 30,000 tons was brought in last year. Anthophyllite is mainly produced from a small mine in Finland, with an annual production of 15,000 tons; only a small amount of this is used in Britain. About 500 cases of cancer of the lung and mesothelioma are known to have occurred among people exposed to asbestos dust in the United Kingdom. This is hardly significant when one realises that more than 25,000 cases of carcinoma of the lung are diagnosed each year.

On current evidence from South Africa, Australia and Britain, it would appear that crocidolite is mainly implicated in the development of the mesotheliomas. However, cases have occurred in the United States, Canada and a few in Britain in which the people concerned appear to have only been exposed to chrysotile. The major problem at the moment is to establish whether only one type of asbestos is responsible for the development of these tumours, and if other varieties can be exonerated. Exposure to only one type of asbestos is unusual in a manufacturing country such as Britain, therefore to find populations exposed to a single type of asbestos, surveys have to be undertaken in the mining areas. It is also hoped that information obtained from animal experiments may be valuable in the assessment of this hazard.

Members of the staff of this Unit have played a prominent part in the discovery and investigation of the association between mesotheliomas and exposure to asbestos dust. They were concerned in the original definition of the condition in South Africa, its recognition in Britain, and the development of the international research programme which is now in operation.

JCW/Y
16.2.67

Pneumoconiosis Research Unit,
Llandough Hospital,
Penarth, Glamorgan.

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HILL AND KNOWLTON, INC.
Public Relations Counsel
150 EAST FORTY-SECOND STREET
NEW YORK, N.Y. 10017
212-697-3600

CARL THOMPSON
Vice President

ENVIRONMENTAL HEALTH UNIT

December 6, 1967

Mr. W. P. Raines
Director of Public Relations
Johns-Manville Corporation
22 East 40th Street
New York, N.Y. 10016

Dear Bill:

Attached is a report from data of the U.S. Office of Vital Statistics concerning trends in stomach cancer for the U.S. and selected cities.

The report essentially merely sets forth factual data from these statistics. Considerable differences from year to year in the same cities and between cities will be noted and should be expected from data of this type. Where there is an up, down and up, or a down, up and down, for the three years, within the same range, there probably is no significance in these changes at all.

Also, it should be remembered that, generally speaking, urban areas report a higher incidence of cancer of all types (with the exception of skin) than do the more rural areas.

The table giving mortality ratios for stomach cancer in the U.S. shows a steady downward trend from 1947 to the present. Since this is the average for the entire country, obviously some sections will show higher and some lower incidence than for the U.S. as a whole. Data for the individual cities is not available prior to 1960. However, any marked deviation from the U.S. trend since 1947 would show up in abnormally high figures for a particular city -- which does not appear in any of the cities listed, keeping in mind that the city incidence is going to be higher generally than the national average as compared with the rural incidence. For example, Providence, R.I., which shows the highest percent of stomach cancer is still not out of the range that produces the U.S. average.

These figures clearly show, especially in the percentage of stomach cancer deaths to total deaths, that there is basically very little difference in trends among the cities even though the ranges from the lowest averages to the highest averages are fairly noticeable.

You will also note that there are three random cities thrown in -- Toledo, Louisville and Birmingham -- which are left in because they show that the fluctuations or lack of it in the cities you gave me are not unusual. It

CAPCO KIN 0000126

might be wise to pick a few more cities of this type and drop in to further illustrate these fluctuations since a couple of your cities do not look "good" if you just consider the figures and nothing else.

Of course, the finest pair is the Knoxville-Nashville comparison, which, as you will note, we have given in a separate table.

Sincerely,

Carl Thompson

CT:sdd
Enclosure

Data Relating to Stomach Cancer

During the past 20 years, there has been a unique and marked drop in the mortality from stomach cancer in the United States. The decline in stomach cancer mortality since 1947 has been steady and consistent, as represented by the following table showing U.S. death rates per 100,000 population for "Malignant neoplasm of digestive organs and peritoneum, not specified as secondary." Source: National Office of Vital Statistics, U.S. Public Health Service.

Table I

Year	Cancer of Digestive Organs Death Rate per 100,000 population
1947	55.2
1952	53.4
1957	51.7
1962	49.5
1965 (last year figures available)	48.7
1966 (estimated)	48.4

Since 1960, the Office of Vital Statistics, has listed mortality data from various cities in the United States. These are not death rates, but actual numbers of deaths. However, comparable figures are given for the United States as a whole.

Table II

Deaths from 60 Selected Causes for the United States

Year	Total Deaths -- All 60 Causes	Cancer of Digestive Organs Number of Deaths	% All Deaths
1960	1,711,982	91,035	5.3
1962	1,756,720	92,047	5.2
1964	1,798,061	93,158	5.1

CAPCO KIN 0000128

The decline in the death rate from stomach cancer is reflected in the consistently smaller percentage every two years of stomach cancer deaths related to all deaths from the 60 major causes. By way of comparison here are figures for four cities in Tennessee.

Table III

Deaths from 60 Selected Causes for Standard Metropolitan Statistical Areas

City	Year	Total Deaths -- All 60 Causes	Cancer of Digestive Organs Number of Deaths	% All Deaths
Nashville, Tenn.	1960	3,675	129	3.5
	1962	3,753	155	4.1
	1964	3,787	159	4.1
Knoxville, Tenn.	1960	3,038	131	4.3
	1962	3,006	132	4.3
	1964	3,120	125	3.9
Memphis, Tenn.	1960	5,476	247	4.5
	1962	5,971	271	4.5
	1964	5,975	279	4.7
Chattanooga, Tenn.	1960	2,661	114	4.3
	1962	2,683	109	4.1
	1964	2,842	103	3.5

It will be noted that the percentage figures for the Tennessee cities are lower than those for the United States as a whole and generally comparable. However, in Nashville and Memphis the percentage of stomach cancer deaths to all deaths has shown a slight rise, while in Knoxville and Chattanooga the rate has been following the national trend.

CAPCO KIN 0000129

It will be noted that the percent of stomach cancer to all cancer varies from above to below the national average but generally they follow the national trend.

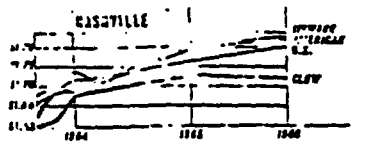
Trends in other selected cities are shown in Table IV.

Table IV

City	Year	Total Deaths -- All 60 Causes	Cancer of Digestive Organs Number of Deaths	% All Deaths
os Angeles, Calif.	1960	58,601	3,110	5.3
	1962	61,353	3,105	5.0
	1964	64,931	3,316	5.1
rovidence, R. I.	1960	7,872	535	6.7
	1962	7,947	570	7.1
	1964	8,087	532	6.5
an Antonio, Texas	1960	5,042	241	4.7
	1962	5,427	287	5.2
	1964	5,411	274	5.0
n Diego, Calif.	1960	7,616	362	4.7
	1962	7,924	463	5.8
	1964	8,448	453	5.3
chita, Kans.	1960	2,368	103	4.3
	1962	2,493	91	3.6
	1964	2,573	120	4.6
bbock, s	1960	1,021	25	2.4
	1962	937	29	3.1
	1964	1,100	31	2.8

Table IV (continued)

City	Year	Total Deaths -- All 60 Causes	Cancer of Digestive Organs Number of Deaths	% All Death
[illegible], Fla.	1960	8,389	503	6.0
	1962	9,409	545	5.8
	1964	10,092	575	5.7
New Orleans, La.	1960	8,918	422	4.7
	1962	8,910	396	4.4
	1964	9,334	422	4.5
Peoria, Ill.	1960	2,675	142	5.3
	1962	2,585	130	5.0
	1964	2,691	152	5.6
[illegible], Mich.	1960	1,629	69	4.2
	1962	1,737	89	5.1
	1964	1,655	89	5.4
[illegible], Ohio	1960	4,711	247	5.2
	1962	4,758	266	5.6
	1964	4,769	296	6.2
[illegible], Ky.	1960	6,915	348	5.0
	1962	7,121	336	4.7
	1964	7,301	341	4.7
[illegible], Ala.	1960	5,987	253	4.2
	1962	6,192	247	4.0
	1964	6,390	258	4.0



Clow Low in Metro . . .

This graph shows the patterns established during recent years in cast iron pipe purchases by Nashville,

. . . U.S. is

This graph shows the pat years in cast iron pipe purchas

[illegible] Nashville, Columbia and Murfreesboro [illegible] cast iron pipe purchases by Nashville.

Above [illegible] Nashville [illegible] Clow Low in Metro . . . [illegible] . . . U.S. is [illegible]

[illegible] Nashville [illegible] Columbia and Murfreesboro buy primarily from American [illegible] a firm which [illegible] high on Nashville [illegible] specifications.

On May 28, 1964, American submitted a low bid on 12-inch pipe in Murfreesboro of $7.78 per linear foot, U.S. Pipe had $8.23, while Clow had $8.188.

On May 18, American's bid to Nashville on 12-inch pipe was $8.185 per foot, Clow was low at $8.188, U.S. and McWane submitted bids of $8.28 and $8.12 respectively.

[illegible] this year, Murfreesboro has purchased pipe from American without formal sealed bidding. The going price for 6 inch pipe has been $[illegible] per foot.

[illegible]'s price on 6-inch [illegible] has also been $[illegible].

[illegible] sealed bids from both Clow and American on [illegible] were a low $1.78 a foot.

[illegible] was $1.78 a foot. Four days later, the company's bid on a Nashville contract was $1.79, while Clow bid $1.72.

In February of the same year, American bid $1.79 in winning a Columbia contract. The same month Clow won Nashville contracts with a price of $1.721, while American submitted the high bid of $1.78.

Lawrence said he did not see the price differences between Nashville and surrounding towns as significant, but added that prices submitted by sealed bids are usually higher than those received over the telephone.

"If I could get on the telephone and negotiate I could probably get lower prices," he said. "Sealed bids tend to be a little higher."

REPRESENTATIVES of U.S. and Clow agreed that the same class pipe delivered to smaller towns at higher freight rates and in smaller quantities should cost more than the shipments to large cities.

"The only possible differ-

company engaged in completion work superintendent manufacturers in bid for purchases by the Harpeth Valley Utility District.

Bids were taken, by a private contractor, Campbell and Dun Construction Co., in Columbia, Tennessee for the first, however, and they have no records of who bid on the pipelines or for what price the pipe was actually purchased.

W. J. Reeves Jr., of Nashville, a representative of James-Nashville, a manufacturer of asphalt-cement pipe, said if Mayor and other citizen-appointed committees, cost could be cut by 25%.

"On the amount of pipe purchased by Nashville, I would say we could save approximately $25,000 a year," he said. "Cast iron pipes would have to be reduced that much to stay competitive with us."

[illegible] Sewer [illegible] cast iron and we haven't any change in specifications.

"It is our feeling that cast iron is best for the system. We have cast iron pipe in the ground that has been there 120 years," he said. "I don't know [illegible] cement pipe in my system."

The waterworks director [illegible]

AFTER A DAY in their the question over, Cramer telephoned THE NASHVILLE TENNESSEAN with the answer:

"Nashville doesn't fit our advantage. We tend to go more for volume. While Memphis buys only once or twice a year, we are asked for bids in Nashville almost every month."

Cramer added, however, that U.S. is interested in Nashville's market and plans to be competitive. The official also pointed out that U.S. had lost a bid in Memphis in 1957 while first break in the pattern in three years.

The freight rates higher from Birmingham foundries to smaller Tennessee cities (50.25 per ton and higher) the pipe cost prices should be higher. The TENNESSEAN survey shows this is not necessarily true, especially when smaller municipalities usually buy smaller quantities.

The best comparisons can be made between Nashville and two surrounding cities — Murfreesboro and Columbia, both buy Class 150-52 pipe, which industry spokesmen say is comparable to the Class 150-52 cast iron pipe purchased by Metro.

SPECIFICATIONS differ between Murfreesboro and Columbia and specifications set out by the American Water-

CAPCO KIN 0000132

dular proliferations and adenocarcinoma may at times be difficult. Of distinctly more definite character as to the production of cancers of different histologic types in the lungs of rats are the observations recently reported by SHABAD and by OSHIMA. These investigators succeeded in producing carcinomas of the bronchial epithelium by introducing into the trachea of rats carbon particles to the surfaces of which known polycyclic aromatic hydrocarbons (3,4-benzpyrene; 7,12-dimethylbenz(a)anthracene) were adsorbed. Through this manipulation a prolonged action of the carcinogen on the bronchial mucosa was obtained, since the carcinogen was only gradually released from its binding to the carbon particles. It may be mentioned that probably a greater part of the carcinogenic polycyclic aromatic hydrocarbons present in polluted air of coal tar operations as well as in urban areas, exists in this type of binding and does not consist of free molecules, as this has been assumed for aromatic carcinogens in cigarette smoke. The experimental evidence cited indeed suggests that carcinogens in free molecular form in the inhaled air are apparently carcinogenically less effective than those attached to the surfaces of particulate matter, such as carbon or iron oxide.

Fig. 43. Cornified squamous cell carcinoma of the skin of a mouse painted with condensate of coal tar fumes.

The inhalation of tarry matter present in the dust obtained from tarred roads (CAMPBELL), or produced by the burning of bituminous coal and used as bedding material (SEELIG and BENIGNUS), caused an increase in the number of pulmonary tumors occurring also spontaneously in mice. No such effect, however, was elicited when mice inhaled directly the smoke from burning bituminous coal (SCHNURER and HAYTHORNE) or when lamp black was employed as bedding material (SEELIG and BENIGNUS) or when they inhaled the heavily polluted air of central Glasgow (PEA-

COCK), or when they became exposed to the fumes given off by heated coal tar (MESTITZOVA and KOSSEY, HUEPER and PAYNE). Similarly equivocal results were observed when rats, and guinea pigs inhaled for up to two years, coal tar fumes or soot obtained from smokestacks of coffee roasting plants although condensed coal tar fumes as well as coffee soot displayed definite carcinogenic properties when subcutaneously or intramuscularly injected into rats and mice (HUEPER and PAYNE) (Tables 66 and 67), (Fig. 43).

Table 66. *Neoplastic Reactions in Rats, Guinea Pigs, and Hamsters Inhaling Maximal Tolerated Doses of Fumes from Heated Coal Tar and Petroleum Asphalt, Cutting Oil Fog, Coffee Roast Soot for Up to 24 Months*

Substance	Species	No.	Tumors of Lung: Adenoma	Tumors of Lung: Carcinoma	Neoplastic Reactions of Other Sites: Bladder	Liver	Lymph Node	Uterus	Others
Coal Tar Fumes	Rat	75	0	0		6	2		
	Guinea Pig	42	0	0					
Petroleum Roofing	Rat	65	0	0		3	2	1	
Asphalt Fumes Cutting Oil Mist	Rat	105		1		1			
	Guinea Pig	65	0	0					
Coffee Soot Dust	Rat	60	3	0		10		1	6
	Guinea Pig	25	2	0	3				

Table 67. *Cancers of the Skin and Muscular and Subcutaneous Tissues of Mice and Rats Produced by the Administration of Condensates of Fumes of Heated Coal Tar and Petroleum Asphalts, of Paraffinic Cutting Oil, and of Acetone Extract of Coffee Roast Soot*

Substance	Species	No.	Route of Administration	Cancers at Site of Administration	Cancers Remote from Site of Administration
Coal Tar Fume	Mouse	50	Skin	22	
Condensate Petroleum Roofing	Mouse	50	Skin	1 (?)	
Asphalt Cutting Oil	Mouse	50	Skin	1	2
		100	Muscle		4
Coffee Roast Soot Extract	Mouse	100	Muscle		2
		100	Muscle	1	2
	Rat	60	Skin	1	4
Coffee Roast Soot	Rat	30	Muscle		3
4 Petroleum Road Asphalts	Mouse	250	Skin	2	7
		200	Muscle	3	1
	Rat	120	Muscle	13	16

If thus the experimental production of lung cancers in animals by the mechanism and route of exposure evidently operating in the causation of cancers of the respiratory tract by the inhalation of coal tar fumes and dust has remained a disappointing procedure, this methodologic inadequacy is shared with that of most other known human respiratory carcinogens (HUEPER). However, such shortcomings in experimental test methods do not negate the convincing and conclusive evidence provided by clinical and epidemiological data obtained on human population groups exposed to the inhalation of coal tar and pitch fumes and dust and developing cancers of the respiratory system because of it.

CAPCO KIN 0000133

10. Petroleum — Mineral Oil — Wax — Asphalt — Petroleum Carbon — Carbon Black — Methylated Naphthalene — Combustion Products — Shale Oil and Derivatives

a) Technological Aspects

Mineral oils and related products, such as waxes, tars, asphalts, and pitches, can be obtained by the distillation and fractionation of various natural raw products, such as petroleum, oil shale, bituminous coal; natural asphalts, and hydrogenated coal (Hueper; Goldblatt and Goldblatt; Page *et al.*; Lipinsky) Since these raw products vary according to their derivation among each other as well as among members of the same group in their chemical composition, and because this variety is distinctly influenced for their derivatives by the types of processing procedures used, the great majority of these products lacks any definite chemical uniformity and standardization. Nevertheless, the general rule can be applied that derivatives which have been obtained by the application of high temperatures resulting in the formation of cyclic compounds (Auld) or are the result of cracking processes (Hoyt *et al.*) contain polycyclic aromatic hydrocarbons, some of which are recognized and potent chemical carcinogens to man and animals (Hieger and Woodhouse; Twort and Ingram; Lee, Priestley, Reimer and Hale; Shubik, Saffiotti, Lipinsky, Petura *et al.*; Lipinsky, Doniney and Raha; Eichhorn and Tetschack; Tebbens, Thomas and Morai)

Although it has been claimed that only such products having a high boiling point are carcinogenic, human and experimental observations definitely show that also derivatives distilling over at a boiling point below 700 °C. such as methylated naphthalenes, may possess carcinogenic properties (Shubik and Saffiotti; Hueper and Cahnmann; Andervont; Pole; Horton, Denman and Trosset; Kotin, Falk and Thomas; Lijsbraugh; Lijsbraugh and Halbert).

In fact, there exists an increasing amount of evidence incriminating not only aromatic components of mineral oils and related chemicals in the production of cancers, but also aliphatic chemicals such as paraffins, aliphatic epoxides (ozonized gasoline) and nitro olefins (Shubik, Saffiotti, Lipinsky *et al.*; Kotin, Falk and McCammon; Kotin, Falk and Thomas; Kotin and Falk; Juhasz; Deichmann)

The carcinogenic properties of these materials is being attested by numerous reports relating the development of cancers of the skin, including scrotal skin, in various types of worker groups having an occupational contact with them (lubricating oil, paraffin oil, cooling oil, waxes, fuel oil, asphalt and coke of soils, plasticizers in tiles, fillers in rubber, electrode components, etc.) as well as in several species of experimental animals to which they were applied or injected (Henderickx, Berry, Lijone and Thorpe; Lijone; Southam and Wilson; Henry; Wade; Ecrabbe; Holt; Page *et al.*; Smith and Sunderland; Cruickshank and Gourevitch; Cruickshank and Squire; Auld; Breicerbank; Squire, Cruickshank and Torpey; Fife; Gutman and Vesselinovitch; Mastromatteo; Spink; Baynes and Tomlinson; Hueper and Payne; Simmers; Hueper and Cahnmann; Sellschopp and Carl; Wynder; Sunderland, Smith and Sugiura; Twort and Twort; Visanai; Coon, Carbutiers and Woodhouse; Winkhouse; Lijnsky *et al.*; Wade; Mac Kenna and Horner). The great majority of the occupational oil cancers of the skin were reported from Great Britain. Not more than 10% of the observations originated from the United States despite their much more extensive production and use and a greatly higher production of petroleum derivatives in the U.S.A. than in Great Britain. As a partial explanation of this astounding phenomenon, reference may be made to a remark of Ecrabbe who stated that, "the carcinogenicity of cutting oils is of such a low degree that good personal and industrial hygiene practices should eliminate any cancer hazard associated with these materials". The perhaps industrially unpleasant fact nevertheless exists — despite this admonition of taking rather lightly possible cancer hazards from such agents — that cancers of the skin from occupational contact with cutting oils have been observed in American metallurgical establishments They regrettable, however, have not been made a matter of public record although such effects were demonstrated also in experimental animals (Hueper and Payne). Litigations regarding such cases were rather settled out of court. The occurrence of skin cancers in man and experimental animals from exposure to cutting oils, on the other hand, has been reported by Canadian investigators (Mastromatteo; Gutman and Vesselinovitch).

Only one American oil company has chosen to publish its more recent experiences on the occurrence of cancers of the scrotal skin in paraffin pressers (Henderickx, Berry, Lijone, and Thorpe; Lijone and Denholm) and has done this only after a delay of ten years when the paraffin pressing process for obtaining waxes had been replaced by the solvent process, although wax cancers have been known for many years (Davis, Longmire; Hueper). Since similar conditions of exposure to carcinogenic oils from which crude or "slack" wax is pressed have prevailed in other oil companies, according to reliable observations, it stands to reason that some such cancers must have occurred also in employees of these companies. Whether many of the victims of these occupational petroleum wax cancers received compensation for having contracted an often fatal occupational paraffin oil cancer, appears to be doubtful because of the statutory time clause which limits the making of such claims. It is also symptomatic of the general policy adopted in the management of information on such matters that the very extensive experimental data on carcinogenic properties of petroleum products obtained at a Midwestern university under the sponsorship and with the financial support fo the American Petroleum Institute during twelve years of research, have not been published in printed form but seem to be considered still as "privileged information" if Ecrabe's philosophy in such matters should have been adhered to. The observation on oil cancers has suffered the same fate, which was assigned to a similar study on coal tar cancer hazards, which was conducted at the same university during the same period, and which was carried out under the sponsorship of a group of coal tar producers who had been stimulated by Hueper to engage in such research in 1950.

A disconcerting amount of human and experimental evidence attests to a carcinogenic effect of fully-refined hard, soft and liquid paraffin products not only on animal tissues but also on human tissues when applied to the skin, ingested, inhaled, implanted into the lumen of the urinary bladder, or parenterally injected (Colcott; Schurch; Schmähl and Reiffer; Boyd and Dible; Hueper; Drucrey, Schmähl and Preussmann; Nettleship; Shubik *et al.*; Bonser, Rutland, Bussy and Clayson, Bonser, Clayson, Jull and Pybus; Quilty; Mehs; Bonser, Clayson and Jull, Potter and Robertson; Irving, Gutmann and Larson). Shubik *et al.* reported the presence of 1,2,5,6-dibenzanthracene in fully refined paraffins used for the coating of milk containers, and Prudnikova and Znamensky recorded the

CAPCO KIN 0000134

demonstration of 3,4-benzpyrene in paraffins of Russian make. Whole petroleum waxes meeting certain physicochemical specifications are permitted in the food industry of the U.S.A., the two Russian investigators recommended that the foodstuff industry should be subject to controls in regard to the use of such waxes. The experimental production of cancers in the subcutaneous tissue of mice receiving implants of pellets of fully refined paraffin in which such impurities of carcinogenic aromatic hydrocarbons were not demonstrable with the most sensitive available methods — indicates that a carcinogenic effect of paraffin seems to depend on both aromatic and aliphatic chemical constituents of crude, semi-refined and fully refined waxes.

Apart from the various contacts which human population groups have with these carcinogenic agents for occupational and economic-environmental reasons, such exposures may occur also because of the pollution of some natural media with native petroleum oils. Such petroleum oils and the polycyclic aromatic hydrocarbons contained in them have been demonstrated in the sediments of the Gulf of Mexico (Whitehead and Breger; Smith; Baker; Muir and Freimann) as well as in South African asbestos (crocidolite) (Harington), and in manganese nodules of the western North Atlantic (Thomas and Blumer). These findings indicate a rather wide range of natural occurrence of polynuclear hydrocarbons related to natural types of mineral oils and their prolonged preservation in strongly oxidized sediments over many thousands of years. Natural crude petroleum, moreover, has seeped in and contaminated in some areas of the United States, local drinking water supplies. Petroleum and mineral oils from natural sources, as well as from dumping ship fuel oil and escape of engine exhausts into ocean, lake and river waters, especially on or near harbor areas, has been polluting to an increasing degree all bodies of water within or near industrialized countries (Cahnmann and Kobayashi; Hueper).

It is noteworthy in this connection that non-processed natural bitumen or asphalt, such as that mined from the "asphalt lake" in Trinidad, has not displayed any carcinogenic properties in man (Zeleny) and experimental animals (Hueper), although crude natural petroleum oils, particularly those rich in aromatic compounds, have induced cancers when applied to the skin of mice and rabbits (Hieger and Wormwood; Twort and Fulton) and may have been involved in the causation of skin cancers in oil field workers (Schwartz, Tulipan and Birmingham).

Carcinogenic constituents of mineral oils and derivatives are emitted into the air in numerous occupational activities where they are used in the manufacture of numerous products (rubber, plastics, steel, linoleum, etc.) or as lubricants, coatings and as fuels. They are present in automobile exhausts and in the effluents of oil refineries and filling stations.

Exposure to various types of petroleum products is rather widespread for the populations of industrialized countries for both occupational and environmental reasons (dietary, cosmetic, medicinal, atmospheric, aquatic, sanitary, etc.) (Hueper). They form constituents of polishes, paints, pesticide preparations, paper and food container coatings, printing materials, water repellents of brick walls and textiles, lubricants, fuel oils, and many other products used in plants and homes (Division of Air Pollution; Hendricks).

b) Epidemiology

Occupational respiratory contact with these products may be due to an inhalation of oil fogs, mists and sprays, such as those encountered under occupational conditions on paraffin pressing sheds, metal lathe operations, spraying of pesticide preparations, investment casting, high pressure lubrication, diesel jet testing, paraffin oil spraying of brick construction, textile spinning, and printing, and complications also exposures to combustion products in automobile and diesel engine exhausts (Jones; Tomeo *et al.*; Hueper; Meyer-Bisch). A habitual and occupational inhalation or ingestion of mineral oil containing nasal and laryngeal sprays creates a similar respiratory contact with paraffin oils and also may cause an oil pneumonia (Lee and Higham; Passmore *et al.*; Jamieson *et al.*; Sante; Wood). While it has often been asserted that the ingestion of such oils for laxating purposes may lead to an aspiration of such oils into the lungs and thereby to the development of an oil pneumonitis, it is more likely that the oil droplets retained under such conditions in the lungs enter the body through resorption by the intestinal mucosa from where they are transported into the blood of the vena cava inferior, the thoracic duct and the pulmonary arterial system. Here they are retained finally within the pulmonary capillaries (Daniel, Frazer, French and Sammons; Hueper; Meyers and Gallup; Schmeltzer; Editorial) and thereby give rise to inflammatory and possibly cancerous reactions.

Lung and larynx cancer hazards from occupational exposure to finely dispersed or nebulized oil in the inhaled air have been recorded by Huguenin, Fauvet and Bourdin for metallurgical workers, chauffeurs, garage mechanics and engineers. Kennaway and Kennaway noted a relatively high ratio of laryngeal cancers, but not of pulmonary cancers, in male spinners having contact with shale oil and showing a high attack rate of cancers of the skin, especially the scrotum and vulva. Southam mentioned that male spinners developed occasionally multiple primary cancers involving the lung and stomach in addition to the skin. Reusch observed a combination of three primary cancers (skin, lung and stomach) in a paraffin presser; Touraine and Bonn also attributed the development of cancer of the lung in members of some occupations to their inhalation of lubricating oil mists. Such exposures may account also in part for the excessive lung cancer mortality among male metal grinders observed by Turner and Gratz. A similar observation concerning a special liability to cancer of the lung by metal turners, mechanics, fitters and wood workers was reported by Bernoit. From an epidemiologic analysis of the relation of occupation to cancer of the lung in Japan, Tsuchiya concluded that the only occupational group showing a higher risk to lung cancer were workers exposed to petroleum products.

Additional suggestive evidence on such relationships involving an occupational exposure to oil mist was advanced by Huguenin, Fauvet and Bourdin, and Huguenin, Fauvet and Mazabraud. The epidemiologic analysis of employees of a large Public Utility Company by Christian also provided evidence in support of the view that an inhalation of oil mists and fumes created an excessive liability to lung cancer since substation operators exposed to oil fumes from interruptors, had a lung cancer rate of 433 per 100,000, chauffeurs had one of 238 and mechanics one of 215, while the average rate was 35.4.

Respiratory exposures to mineral oil fogs, mists and fumes are doubtlessly sustained by workers employed in automobile service stations and garages (Fulton), in rolling mills using the cold reduction of steel strip (Jones), in iron casting operations and steel plants (Lawson) where mineral oil baths are employed for quenching purposes; in asbestos-cement plants where mineral oils are used as molding oils (Enca-

CAPCO KIN 0000135

BRIGTSEN); in textile spinning establishments (EVERSOLE), in manufacturers of roofing felt (GOLDBLATT and MCAMIS), in industrial establishments in which mineral oil is used as an air filtering agent in air conditioning equipment (HUEPER), and in large-scale spraying of pesticide preparations which are dispersed in methylated naphthalene. It is interesting to note that EVERSOLE could not detect any special cancer hazard from contact with mineral oils in German textile workers. DUNKER even ventured the opinion that there was no scientific support for apprehension on the breathing of oil mists, either from machine shop work or from insecticide spraying where a gasoline-type vehicle is the vehicle.

While HENDRICKS *et al.* recently concluded from a review of the literature and from their own observations in oil refineries that "there is no evidence to suggest any relation between the inhalation of oil mist and lung cancer" and that petroleum processers do not show an excessive liability to lung cancer, it is noteworthy that the existence of such causal associations are clearly demonstrated among the workers of one of the refineries included in the study of HENDRICKS *et al.* as evident from the data of Table 68 (HOLT).

Table 68. ***Comparison of Lesions Among Persons with 10 Years or More Service with the Normal Male Population Using Adjusted Rates for Both the Persons and the Normal Population*** **(HOLT *et al*)**

Site of Lesion	Adjusted Rate per 100,000		Total Lesions Adjusted	
	Normal Population	Persons	Normal Population	Persons
Lung	30	271	7.3	13.3
Stomach	68	407	16.3	20.0
Intestines	35	135	8.7	6.6
Rectum	34	135	8.3	6.6
Scrotum	0.15	1000		5.10

According to HOLT, the probabilities of the observed cancer cases occurring in the normal population were as follows: Lung: One in 10,000; Stomach: Five in 10,000; Scrotum: Less than 3 in ten trillion. These findings are in general agreement with those made in another oil refinery in which a survey revealed that of 19 cases of lung cancer occurring among the total number of employees of all types, 17 cases involved workers engaged in manufacturing processes and only two (2) affected white collar workers, although their ratio was 1 : 2.

Apart from the fact that cancers have developed at times from cosmetic paraffinomas present in various human organs (BAUER; BAADER; SCHMALTZ and REITER), such developments have been reported occasionally also as sequelae of medicinal oil pneumonia (WOOD; SANTI). The recent observations of BONSER *et al.* on the development of cancers of the bladder in rats with intravesically placed paraffin pellets and of similar neoplasms in the bladder of mice equally treated (MICE) and the production of subcutaneous sarcomas around paraffin implants in mice (SHIMA *et al.*) give convincing testimony of the carcinogenic properties possessed by even fully refined paraffin waxes and paraffin oils. They support the view that the inhalation of such products in nebulized form should create a serious respiratory cancer hazard to the millions of workers employed in many industries, and different occupations, and exposed to oil mists, fogs and sprays (HUEPER and PAYNE).

Of even more serious and general significance in this respect is the inhalation of exhaust fumes emitted from gasoline motors and diesel engines, since such effluents contain not only often unburned fuel in the form of oil droplets but also appreciable amounts of newly created carcinogenic combustion products. The atmospheric pollution with these carcinogenic constituents of the exhausts of automobiles, busses and trucks as well as of many types of industrial machines and airplane motors, is responsible for a considerable fraction of the rapidly increasing smog formation in all metropolitan areas (KOTIN and FALK; LYONS; KATZ; COMMINS; COOPER; WALLER; COMMINS and LAWTHER; WYNDER; MILES; FITTON).

During recent years repeated attempts have been made to minimize the cancer hazards to respiratory organs which might result from the release of diesel engine exhaust into the air of workshops as well as of the general environment, by claiming that such effluents while being toxic, do not contain any carcinogenic polycyclic aromatic hydrocarbons if the operation of a diesel engine is well adjusted (COMMINS, WALLER and LAWTHER; COMMITTEE ON MEDICAL SCIENCE, EDUCATION, and RESEARCH). Support for this general allegation has been provided by the failure of several experimental investigations in obtaining skin and lung cancers in mice or rabbits, respectively, which were either painted with diesel engine exhaust soot or inhaled it (MEEHAN and NICHOLSON; SCHMIDTMANN).

Such assertions should not be accepted as valid for the following reasons. Since the type of exhaust released from diesel engines depends upon the type of engine and the fuel supplied to it as well as on the conditions under which an engine is operated (*availability of oxygen, workload*), *there probably does not exist any typical diesel* pollution (BATTIGELLI). The ideal operating conditions used for demonstrating the carcinogenic innocuousness of diesel engine exhaust do not exist under many "normal" conditions of operation of diesel engines and many of these engines are not kept in proper working condition. This is visibly apparent from the frequent release of thick black soot from the exhaust pipes of diesel trucks. Such soot does not contain only carbon but also *carcinogenic polycyclic aromatic hydrocarbons* (KOTIN; SULLIVAN and CLEARY; BATTIGELLI; KOTIN, FALK and THOMAS; CLEMO). The carcinogenic chemicals present in the diesel engine exhaust therefore, can be expected to be present whenever a diesel engine is subjected to excessive strain usually caused by an overload or when it is operated in an environment with limited oxygen supply (mines, tunnels) (WALLER, COMMINS and LAWTHER; HOLTZ; CROSS; SULLIVAN and CLEARY). Such pollutions are likely to exist also in inadequately ventilated diesel engine test rooms and repair shops (CARBIANI).

While the available human evidence does as yet not definitely establish whether an occupational inhalation of diesel engine fumes has solely been responsible for the production of lung cancers in man, the carcinogenic constituents in their exhaust certainly would tend to aggravate the total load of inhaled carcinogenic chemicals in all individuals exposed to such atmospheric pollutants. Diesel engine exhausts thus may significantly contribute to the development of lung cancers among members of such population groups. The epidemiologic studies by KAPLAN and by RAFFLE on the lung cancer liability of operating railroad workers in the United States and in England have led these investigators to the conclusion that the lung cancers observed among these railroad workers did not have any apparent causative relationship to diesel fume inhalation. The statistical methods used by KAPLAN and the control

CAPCO KIN 0000136

groups chosen by him to prove this claim, however, are of a type which destroys any scientific value of the conclusions reached by KAPLAN from his data. The negative evidence by KAPLAN, moreover, is refuted by observations published by HUEPER on this subject, who found that 75% of all lung cancers among colored employees of two large American companies were found among operating railroad workers who constituted only 25% of the total number of employees. KAPLAN's findings also disagree with the data obtained by ROSS from an analysis of the rapid growth of the lung cancer rate among members of the Brotherhood of Railroad Trainmen between 1935 and 1952 (Table 69) (10 fold).

Table 69. *Incident of Cancer other than of the Lungs from Insurance Records of the Brotherhood of Locomotive Engineers, Brotherhood of Locomotive Firemen and Enginemen, and Brotherhood of Railroad Trainmen*

Year	Deaths from Cancer other than that of the Lungs			
	Firemen (per 100,000)	Trainmen (per 100,000)	Engineers (per 100,000)	Total
1942	77	164	75	316
1943	79	161	83	323
1944	88	190	93	371
1945	74	176	88	338
1946	92	215	91	398
1947	91	229	76	396
1948	76	200	82	358
1949	85	240	86	411
1950	77	206	74	357
1951	87	230	109	426
1952	81	238	80	399
Totals	901	2,249	937	4,097
Increase Cancer (less lung) comparing 1942–1951	5.19%	45.12%	6.67%	26.27%
Increase Cancer (less lung) comparing 1942–1951	12.99%	40.24%	45.33%	33.81%
Average Increase of Cancer (less lung) for 10 years, 1942–1951, incl.	6.49%	22.56%	14.67%	16.71%

January 25, 1954, E. S. Ross, M. D., Chief Medical Director, Brotherhood of Railroad Trainmen.

Chemically similar exposures are sustained by petroleum asphalt workers, road construction and repair workers, tile makers, carbon electrode manufacturers and users, and many others who inhale petroleum asphalt dust and fumes with demonstrated carcinogenic properties (LOCKHART; MALY and MAIER; HUEPER and PAYNE; SIMMONS).

Such pollutions with carcinogenic hydrocarbons generated by the incomplete combustion of gasoline and motor oil may recently have been intensified by the introduction of possibly carcinogenic additives, such as lead naphthenate, carbon tetrachloride, 1:1:1-trichlorethane, etc. to gasoline (BATTMAN, COMMONER and

PRATT, DOUTHIT). A similar observation was made also in regard to additives used in cutting oils which, when applied to the skin of mice, induced cancer formation (GERMAN and VESSELINOVITCH).

Finally, attention may be called to types of exposure to petroleum products which may create respiratory cancer hazards for workers employed in tobacco sheds in which tobacco leaves are cured by exposing them to the heat and soot generated by the burning of carcinogenic residual fuel oils, or for workers in and residents of quarters which are heated with stoves and burners using kerosene or petroleum oil as fuel (DIXON), or for agricultural laborers employed in or living near orchards and vegetable fields protected against cold spells by the burning of old rubber tires and fuel oil in smudge pots, by the production of large amounts of soot. The failure to produce skin cancers in mice (MOSCHCOWITZ and SCHWARZ) treated with a concentrated benzol extract of oil soot from a domestic oil burner in an ointment base cannot be considered as a competent type of experimental study since the maximal duration of the experiment was only 272 days and was, therefore, insufficient for covering even half of the normal latent period of a bona fide carcinogenic bioassay on test materials of the type used (HUEPER and CONWAY; HUEPER and PAYNE; KURATSUNE and HUEPER).

The numerous observations on the causative role of polycyclic aromatic hydrocarbons present in various carbonaceous materials widely used for the production of heat and energy in the human economy and discharged often into the air of work rooms and communities without any consideration of the possible and even actual respiratory cancer hazards created thereby, deserve serious attention by all public health agencies if any rational prevention of respiratory cancers is to be attempted (SUGA).

11. Ionizing Radiations

a) Technological Aspects

Exposure of man to ionizing radiations (alpha-, beta-, and gamma rays) occurs from natural as well as man made sources. Natural radiations act either from external sources, such as cosmic radiation and radiations arising from radioactive elements present in the crust of the earth and as potassium 40 and carbon 14 in organic matter, including foodstuffs. Radioactive matter present in the atmosphere in the form of gas (radon) or dust may be inhaled or ingested and may consist of natural elements or, if the product of atomic nuclear operations, may be of man-made origin. X-radiation or Roentgen radiation generated by many devices such as cathode tubes, x-ray tubes, electron guns, x-ray diffraction apparatus, radioactive static eliminators, television tubes and radar apparatus, is essentially a product of man-made activities.

While all *living matter*, including man, has been exposed since time immemorial to usually minor doses of natural ionizing radiations from external sources and has withstood such influences without any apparent major biologic injury, this situation has undergone, since the turn of the century with the discovery of radioactive chemicals and x radiation, and particularly since the more recent development of atomic energy during the last 20 years, fundamental changes. During this period, health hazards and especially cancer hazards to man from contact with radioactive chem-

CAPCO KIN 0000137

cers in two (2) of the eight (8) cases in which a post mortem examination was not made. Thus lung cancer was found in 15 of 24 miners (71 per cent). By 1939, there were only approximately 70 miners employed in the Schneeberg mines. In about 75 to 80 per cent, lung cancer was the cause of death in members of this relatively old worker group (Hueper). The rather frequent nodular origin of the Schneeberg lung cancers noted by Schmorl and by Reichelt (25% of the cases) was not evident at that time among the seven cases examined by Hueper. Epidemiologic studies performed at that time on control worker groups, including miners working in non-radioactive or weakly radioactive mines and in plants as well as in the general population in the vicinity of Schneeberg, did not reveal any excessive lung cancer incidence (Rostoski, Saupe and Schmorl; Hueper; Rostoski). Schneeberg lung cancers were still observed in 1957 according to a report of Sevai.

The statistical data on lung cancer rates among Schneeberg miners together with comparative figures for lung cancer rates in the population of Vienna presented by Peller in 1939 demonstrate adequately the scope of the cancer hazard existing at Schneeberg (Table 70).

Table 70. *Crude Cancer Mortality per 1,000 in Schneeberg Miners*

	Miners in Schneeberg		Viennese Males 35–70 years of age
	1875–1901	1895–1912	1912–1936
Lung Cancer	12.7 | 1.0	16.5 | 1.5	0.11
Cancer of Other Organs	2.4 | 0.4	2.1 | 0.6	2.1

The exposure time ranged from 10 to 45 years and averaged 25 years. The lag period varied in several former miners between 10 and 17 years (Rostoski; Schmorl). The average age was during the early period (before 1901) 38 years (Ulrich) and rose to 55 years by 1926 (range 37–69 years (Rostoski, Saupe and Schmorl). It was noted by Harting and Hesse that drillers and hewers developed lung cancer at an earlier age and with a higher frequency than other underground workers, such as carpenters and masons. Drillers and hewers, therefore, sustained apparently the most severe exposure to the causal agents (*radioactive dust and gas* in addition to silica dust, arsenic, etc.) (Neuzil).

Among 41 cases which were analyzed for their specific histologic type, 26 were squamous cell carcinomas, 14 were small cell carcinomas, some with giant cells (Fig. 44), and one (1) was a multifocal carcinoma which exhibited both small cell and adenocarcinomatous structures. Radiation cancers of the lung as observed among Schneeberg miners thus adhered to the general pattern of histologically diverse responses to the same etiologic agent.

Etiology: During the early period after the discovery of these lung cancers when radioactivity of chemicals was still unknown, it was supposed that the development of these neoplasms was related to the heavy exposure to silica dust, i.e., to silicosis pneumoconiosis sustained by these miners. However, silicosis was, as a rule, not very extensive in miners with lung cancer (Rostoski; Siebel) and Hueper noted that silicosis had no causal relation to these cancers. Also speculations as to a contributory role of an occupational contact with water in the mines causing a tendency to the

frequent occurrence of colds were advanced (Harting and Hesse). Schmorl pointed out that such cancers seemed to originate from pulmonary scars. After the chemical composition of the ore had been ascertained, various metals contained in the ore, such as cobalt, bismuth, nickel, chromium and arsenic, were considered as being causally involved in the production of these tumors (Harting and Hesse; Rostoski and Saupe). Arsenic attracted special consideration in this respect since the ore contained 0.5 per cent of this mineral (Rösel; Rostoski). It was assumed that fungal growth might tend to volatilize the arsenic present in the ore and thus cause it to be inhaled. However, the miners had no signs of arsenic poisoning and the molds proved to be inactive. This etiologic concept was later more or less

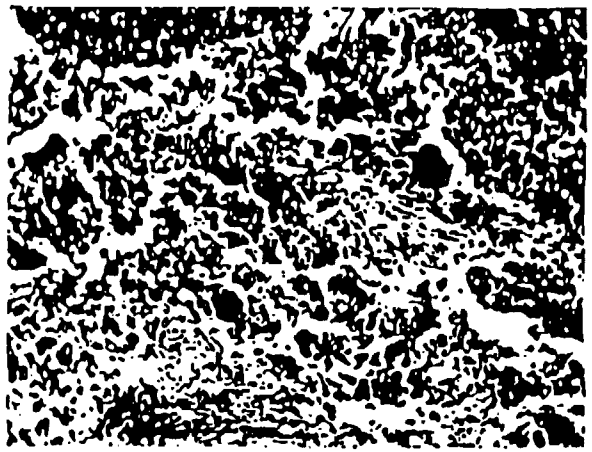


Fig. 44. Anaplastic carcinoma of the lung in a Schneeberg miner

abandoned (Schmorl; Loutit), and arsenic remained merely for some time as a possible contributory factor in the speculations entertained by several investigators on the etiology of these cancers (Lorenz).

Vesin, as well as Lorenz, proposed the hypothesis that also genetic, hereditary factors associated with an assumed inbreeding of the population at Schneeberg might represent a contributory factor. Considering the fact that Schneeberg, around the turn of the century, was a town of 10,000 inhabitants and was supplied with railroad connections with the rest of the world, "inbreeding" as a cause of endemic predisposition in such a community can scarcely be taken seriously.

Following the discovery of radioactivity in the air and dust of the Schneeberg mines after the turn of the century, the causal importance of this factor has received increasing attention. The prolonged inhalation of radioactive matter present in the mine air seems to be at present generally accepted as the real cause of the lung cancers observed for so many years and at such a high incidence among the miners at

CAPCO KIN 0000138

and after 1952, continued by the Division of Occupational Health, U.S. Public Health Service, and the Epidemiology Branch, National Cancer Institute, suggest that similar exposure conditions may account in total or in part for the excessive frequency of pulmonary cancer among non-uranium metal miners of this region. The original epidemiologic investigations conducted on this subject by HUEPER in cooperation with the Division of Industrial Medicine, University of Colorado (PRINCE and WARING; CHURCH) and the Colorado State Health Department (CLEERE; JACOB) between 1948 and 1952, demonstrated that the highest lung death cancer rates for males were present in the central section of the State where industrial and mining activities were prevalent (Fig. 45) and that lower rates were found in the eastern and western sections of this State.

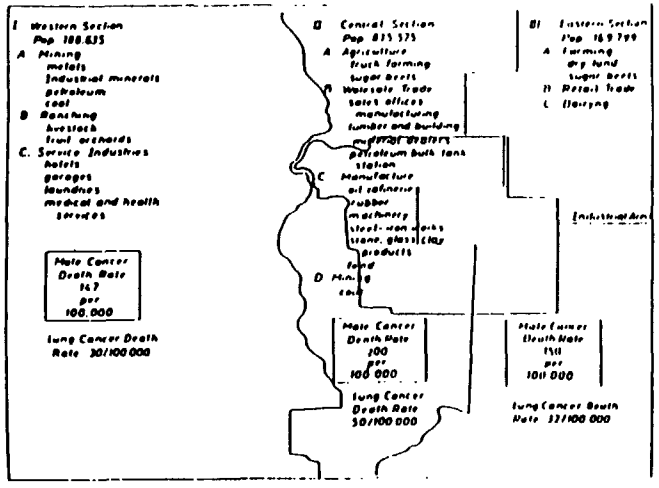


Fig. 45. Cancer death rates for males, 1943 to 1948, in three sections of Colorado.

It is an established fact that many of the non-uranium mines in the Rocky Mountains are radioactive although usually only to a minor degree (JACOB). The metal mines studied by JACOB contained mainly gold, silver, lead, zinc and tungsten bearing ores. The highest concentration of radioactivity found was 2100 uuc/l and in only one location in a single lead mine no radon was found, however 30—60 uuc/l was found elsewhere in the same mine. A study of lead and zinc mines in a specific area gave such a variety of results that no relationship could be established. A group of these mines showed radon concentrations as follows: 119, 201, 151, 26, 176, 259, 1440 and 258 uuc/l, and a similar group in the same district — 160, 180, 110, 120, and 120 uuc/l. The next group in this area however showed only 0—60, 10, 50 uuc/l

This particular district has never produced uranium ores and is situated about 80 miles from the nearest uranium producing mine. In addition to a pollution of the underground mine air with radioactive matter, such mines usually are also contaminated with arsenic containing dust, since arsenic is present in most of the non-ferrous metal ores. It is probable that the inhalation of this atmospheric pollutant may also significantly be involved in the causation of occupational lung cancers (WAGONER, MILLER, LUNDIN, FRAUMENI and HALL) among non-uranium ore miners. The excessive incidence of these tumors in this occupational group is evident from the data of Table 74 (WAGONER *et al*). This table, moreover, shows that in contrast to observations on

Table 74. *Comparison of Foreign Born with Native-Born Metal Miners (Standardized Cancer Mortality Ratio, with Numbers of Expected and Observed Deaths According to Organ System, January 1, 1937, through December 31, 1959).*

Cause of Death	Foreign Born			Native Born		
	Expected Deaths	Observed Deaths	Standardized Mortality Ratio	Expected Deaths	Observed Deaths	Standardized Mortality Ratio
All malignant neoplasms	41.9	78	186.*	32.0	57	178.*
Digestive system	17.8	39	197.*	14.4	12	83
Respiratory system	8.6	21	244.*	2.5	26	347.*
Other systems	13.5	18	133	10.1	19	188.**

* Significant at 1% level. ** Significant at 5% level

higher lung cancer rates in members of foreign born groups than in native ones, native miners have a higher lung cancer rate than foreign born miners. The other factor which may account for this excessive liability to lung cancer among metal miners in the Rocky Mountains region is arsenic.

In critically analyzing these observations, WAGONER *et al.* noted that histories of cigarette smoking were not obtained in their study; however, it seemed to them unlikely that they would differ substantially from those of uranium miners (WAGONER, ARCHER, CARROLL, HOLADAY and LAWRENCE). These differed from the general population only enough to raise the lung-cancer mortality by an estimated 10 percent. They stated, moreover, that it is unlikely that socioeconomic distribution could account for the excess respiratory cancer rate in their study group, and that any genetic factors might not be suspected of having been operative.

The evidence on an excessive lung cancer frequency among radioactive non-uranium mines deserves global attention despite these uncertainties as to the actual role which an atmospheric pollution of the mine air with radioactive matter may play in this phenomenon, because the existence of similar radioactive air pollution has been recorded for mines of several other countries and states (South Africa; Egypt; Germany; New York) (DE VILLIERS and WINDSOR; HUBACHER; HARRIS AWAAD, EL-SHERBINI, HAMMOND, HAZAA, KHARADLY and VALIC; CHEMICAL and ENGINEERING NEWS). Such occupational exposures, however, have as yet not been associated with any demonstrated excessive liability to pulmonary cancer by the miners employed in such mines. Some studies have dealt with the influence which radioactive mine air might have on the development of silicosis in the lungs of miners (ROSTOSKI; URBER, NICOLAS, MUFTI, OBERHAUSEN and ONSTEAD).

CAPCO KIN 0000139

β) Uranium Ore Miners

βα) Lung Cancer in Joachimsthal Miners

Epidemiology. Uranium ore mining was carried out until World War II mainly for extracting the radium contained in such ores, and less for obtaining the uranium to be used in the production of pigments, glazes, etc. During and after World War II, uranium ore mining was greatly expanded for the manufacture of military explosive devices and subsequently also for exploring the usefulness of nuclear energy for non-destructive, particularly commercial and medical — purposes. Uranium or carnotite or pitchblende mining is carried out in Bohemia, the Congo, Canada, the U.S.S.R., the United States of America, and various other countries. While the German investigators of the Schneeberg situation suspected for many years that the miners' disease known as "radium disease" and frequently observed among the pechblende miners of Joachimsthal (Jachymov) — which lies 30 km. south of Schneeberg on the southern slope of the Erzgebirge — (Schmorl), was identical with the disorders affecting the Schneeberg miners, it was only in 1929 that Löwy substantiated this old supposition when he reported the first cases of lung cancer found in three (3) former uranium ore miners of Joachimsthal, in a radium plant with 60 employees. This first observation was followed by others in rapid succession (Sikl, 1930; Zill, 1930; Reutel, 1931; Pirchan and Sikl, 1932; Peller, 1939; Saupe, 1939; Tietze, 1937; Bettmann and Fort, 1941; Mahler and Zill, 1930; Beddoes, 1927; Watson, 1946). The mines at Joachimsthal employed in 1929 about 400 workers, of whom approximately 100 were miners (Löwy); 320 miners in addition to 80 pensioners were employed in 1931 (Sikl) in these mines.

Sikl reported in 1930 the presence of carcinomas of the lung in eight (8) out of 15 miners and pensioners who came to autopsy and estimated their incidence at 50% in all deaths in members of this occupational group. An additional case was published by Reutel in 1931. In a comprehensive report of Pirchan and Sikl appearing in 1932, nine (9) new cases of lung cancer in Joachimsthal miners were placed on record. They occurred among 323 miners during the years 1929—1930, and were seen among 19 deaths and in 13 necropsies. Saupe found in 1939 among 198 active or former miners subjected to a physical examination, three (3) cases of lung cancer. When in 1939, Peller reviewed the accumulated evidence, he established the following statistical correlations with lung cancer in Joachimsthal miners which are given in Table 75.

Table 75. *Cancer Mortality in Joachimsthal Miners per 1,000*

Cancer of	Joachimsthal Miners to		Saxon Miners 15 Years 1917 1938
	1929–1938	1929–1938 Autopsies only	
Lung	9.8 ± 1.5	8.3 ± 1.6	0.34 ± 0.01
Larynx	0.2	0.3	0.07
Skin	0.2	0.3	0.05
Bone	0.2	0.3	0.12
All other organs	0.45 ± 0.3	0.0	1.86 ± 0.07
All organs	10.9 ± 1.6	9.2 ± 1.6	2.44 ± 0.01

Peller concluded from his epidemiologic studies that the miners of Joachimsthal have, 1. a high percentage of malignancies (53%) among their deaths; 2. a several-times-increased cancer mortality rate due to an enormous frequency of pul-

monary cancers in the age period 35—54; 3. an exceptionally high proportion of primary lung cancers; 4. a reduced incidence of cancer in non-respiratory organs; and 5. an increased mortality from causes other than cancer in younger age groups. He noted, like Schmorl for lung cancers in Schneeberg miners, an increased incidence of multiple primary tumors of the lungs among Joachimsthal miners.

In 1950, Sikl recorded a total of 20 cases of lung cancer in Joachimsthal miners which had been observed between 1933 and 1938, and finally Waelsch noted in 1946 that cancer of the lung accounted for the death of such miners in 45.4% of a total of 63 cases.

The distinct shift in the age at death from lung cancer among these miners is evident from the data collected by Gruckmann *et al.* on this subject: 2 cases were in the age 20—39 class; 11 cases in the 40—49 class; and 7 cases were in the 50 and-over class. The average age at death was given as 47.6 years, which agrees approximately with that noted by Sikl, which was 49 years. The exposure time varied from 9 to 23 years and was given as 17 as an average. The lag period after cessation of employment in the mines was up to 23 years. Among 26 cancers histologically examined, there were 10 squamous cell carcinomas and 15 round cell carcinomas. In one case, the primary site was apparently not the lung, but the pleura and its type was given by Pirchan and Sikl as undifferentiated atypical carcinoma. While some degree of silicosis was seen in all lungs with cancer, silicosis on the whole was not a prominent feature in cases of cancer. In fact, lungs most heavily affected with silicosis were generally free from malignant growth (Sikl; Pirchan and Sikl). These observations were in general agreement with those made in Schneeberg miners.

Pertinent to this problem of the role of silicosis and cancer of the lung in radioactive ore miners are the experimental observations of Watanabe and of Engelbrecht, Thiart and Claassens. Watanabe exposing rodents to radioactive feldspar dust, obtained a fibrosing pneumoconiosis, while this condition did not appear when a non-radioactive feldspar was administered. Watanabe concluded from this observation that the natural radioactivity of inhaled rock dust alone may cause the development of fibrosic nodules in the lung. In the experiment of Engelbrecht *et al.*, rats inhaled a radioactive silica-containing dust of gold mines for testing the premise whether the radioactivity adds to the fibrosing effect of silica on the lung. The investigators concluded that the radioactivity in the dust enhanced the fibrogenic action of silica on the lungs of rats. Radiation cancers in other organs, especially the hematopoietic organs and bones, were absent in Joachimsthal miners.

Etiology. The degree of atmospheric pollution with radioactive matter in the Joachimsthal mines was stated to be 30 times the tolerance dose (Editorial; Peller). It was noted that under such conditions of exposure it is scarcely surprising that in the past, more than half of the miners died of lung cancer (Editorial, 1952). This statement contrasts sharply with the allegation of Tschilewitz (1935) who studied the physical conditions present in the mines in relation to the etiology of the lung cancer. Tschilewitz claimed that it is grossly erroneous that radium introduced into the body by drinking water or air, as found in Joachimsthal, can produce any body injury. He pointed out in support of this astounding contention, that radon inhaled is completely exhaled within 7 hours and that the work-free-interval of 17 hours between shifts is completely sufficient to remove any permanent exposure. Tschilewitz incriminated as the principal causal factor the injury to the structure

CAPCO KIN 0000140

of the lung induced by the inhaled silica. Bronchitis and Lorr, on the other hand, after a critical analysis of the exposure conditions present in the Joachimsthal mines came to the conclusion that the excessive incidence of lung cancer is attributable to the prolonged inhalation of radium emanation present in the mine air. The radioactivity of the air near drill holes was found to be up to 8×10^{-8} curies per liter. The activity of the springs in the mines ranged from 1×10^{-9} to 2×10^{-8}. The lung tissue of some miners contained 1×10^{-11} gm. of radium per gm. of tissue (Lorrain; Evans and Goodman).

The lung cancers in radioactive uranium miners of Joachimsthal, Czechoslovakia and in the radioactive ore miners of Schneeberg, Germany, have been accepted for many years past as occupational diseases to which compensation laws are applicable (Hueck; Löwy; Zeil; Official Report).

ββ) Lung Cancers in Uranium Ore Miners of the Colorado Plateau

Epidemiology. The initial attempt to obtain information on the probable existance of lung cancer hazards in uranium ore miners of the Colorado Plateau was organized by Hueper in 1948 with the cooperation of the Colorado State Health Department and the Division of Industrial Medicine, University of Colorado, School of Medicine, Denver, Colorado. It was planned at that time to ascertain the causes of death not only for uranium ore (carnotite) miners and millers, but also for workers engaged in the mining and milling of various arsenic containing non ferrous metal (silver, copper, zinc, etc.) ores — an activity carried on for many years in the same region. Because of administrative difficulties encountered in the continuation of this epidemiologic survey, it was appropriated in 1951 by the Division of Occupational Health, USPHS, which operated this exploration from then on in conjunction with the Colorado State Health Department and the Atomic Energy Committee.

These shifts in management of the epidemiologic survey in Colorado were brought about by the fact that at that time some Government scientists still believed that the lung was refractory to the carcinogenic action of inhaled radioactive matter and that for this reason, such exploratory studies were not indicated. These officials indeed went so far as claiming that scientists recommending such fact finding epidemiologic procedures in Colorado were displaying "bad scientific judgment" and deserved to be dismissed from the Government service (Hueper). They insisted, moreover, that any mentioning of the extensive experiences made since 1879 on occupational lung cancer hazards in Saxon and Bohemian radioactive mines at Schneeberg and Joachimsthal at medical conferences be suppressed as not being in the "public interest".

The mining of uranium ore on the Colorado Plateau had been a relatively small-scale operation until the latter part of World War II, when uranium ore became in great demand for the production of military explosive devices. The production of this ore rose rapidly after the war, and amounted for the year 1956 to approximately 3 million dry tons yielding one-fourth of one (1) per cent uranium concentrate or about 8000 tons by the end of 1956. In 1957, there were a total of 12 uranium mills operating in the United States. All except one were privately owned. The completion of construction of eight additional mills was scheduled for the end of 1957 or early 1958.

The uranium ore mining industry soon expanded from the Colorado Plateau into adjacent regions (Utah, Arizona, New Mexico, Montana, South Dakota and Wyoming) and employed a rapidly rising number of miners and millers. The study of the health hazards of this occupational group which was started in 1951 comprised about 5,400 miners and millers.

In addition to periodic medical examinations performed on the miners and millers, determinations of the quantity and quality of the ionizing radiations present in the various mines (in 1959 samples were examined of 302 out of a total of 371 mines which employed 3,619 miners) were made (Governors' Conference). When in 1961 a preliminary report on the results of these studies was rendered, it appeared that among 907 white miners with more than 3 years of underground experience, death from respiratory cancer (6 deaths) accounted for nearly five times the normal rate (Archer, Malmstrom, Holaday and Lawrence). A cytological examination of the sputum of uranium miners started in 1957, provided additional evidence suggesting the existence of a radiation specific lung cancer hazard. In 1960, the sputums of 1,788 miners were examined. In the first 272 reports, the sputum of 230 miners was negative, that from 33 was doubtful, and that of nine (9), or 3.3 per cent, was positive for cancer cells.

The subsequent analysis of such correlations published by Wagoner, Archer, Carroll, Holaday and Lawrence in 1964 which covered an observation period extending from 1950 to 1962, yielded confirmatory evidence concerning an excessive liability of lung cancers in American uranium ore miners (Table 76).

Table 76. *Number of Expected and Observed Deaths from Respiratory Cancer in Relation to Duration of Underground Uranium and Underground Nonuranium Mining Experience (White Miners) 1950 Through 1962*

Duration of under-ground uranium mining experience (years)	Duration of Underground Uranium Mining Experience					
	Less than 5 years		5 years or more		Total	
	Expected	Observed	Expected	Observed	Expected	Observed
0	0.7	0	0.6	5[2]	1.3	5[1]
1–4	0.3	0	0.1	0	0.4	0
5 and more	0.7	1	0.4	6[2]	1.1	7[2]
Total	1.7	1	1.1	11[2]	2.8	12[2]

[1] Significant at 5 percent level (B). [2] Significant at 1 percent level (B).

For testing the validity of their conclusion that the cumulative dose of airborne radiation contained within the uranium ore mines was responsible for the excess of respiratory cancers among the miners, Wagoner *et al.* calculated 3 measures of radon-daughter exposure for a number of miners (Table 77).

They found that the mean number of months of underground experience and the mean dose rate of miners with respiratory cancer were greater, though not significantly so, than those of other groups used for comparison. The value of these observations is accentuated by the fact that there was a significant excess of respiratory cancers even among uranium miners with no prior hard-rock mining experience.

Considering the fact that the uranium mines in the Rocky Mountain region are in operation for only a relatively short time, that the peak values of radioactivity in some of these mines were several-fold those noted in the "death mine" of Schneeberg, and that protective technologic measures, i.e., mainly ventilation, were introduced into the operation of most of these mines only after 1950 and did not invari-

CAPCO KIN 0000141

ably produce a satisfactory improvement of the exposure conditions, it is safe to predict that many additional cases of lung cancer and a considerably higher incidence rate of these tumors will become apparent for this worker group during the decades to come.

Table 77. Disease Classification of Uranium Miners According to Radon Daughter Exposure

Disease classification	Number of miners	Mean age	Mean respiratory exposure: Under ground duration in months	Dose rate[1]	Cumulative dose[2]
1. Malignant neoplasms of the respiratory system	25	53.9	88.9	30.9	2,878.4 (X_1)
2. Respiratory diseases other than respiratory neoplasm (includes pneumoconiosis and conditions contributing to cor pulmonale)	24	53.5	74.9	22.6	1,826.2 (X_2)
3. Diseases other than those of the respiratory system (arteriosclerotic heart disease and "other neoplasms")	51	55.0	63.3	16.6	1,107.7 (X_3)
4. Living miners matched with respiratory neoplasms on basis of year of birth, year of initial examination, and exce	50	55.1	63.9	22.3	1,136.6 (X_4)

t value for $X_1 - X_3$ = 1.19 *t* value for $X_1 - X_4$ = 2.01*

t value for $X_2 - X_3$ = 2.15** *t* value for $X_2 - X_4$ = 1.00

[1] Average working level = $\sum_{i=1}^{m} \frac{Xi}{K}$

[2] Average working level months = $\sum_{i=1}^{m} \frac{Xi}{K} \times Yi$

* Significant at 5 percent level-because of the multiple comparison, i.e. 4 groups taken 2 at a time, the exact level of significance is unknown.

where
X = radon-daughter level.
Y = months of exposure at radon-daughter level.
K = $1.3 \cdot 10^8$ MeV of potential alpha energy from radon-daughter per liter of air.
i = 1.2 ... m = number of radon-daughter level measurements.
n = number of miners.

Etiology. In etiologic respects it is important that Waghorn *et al* stated that in contrast to the European uranium mines and to the U.S. metal mines, only minimal amounts of constituents of the ore suspected of carcinogenic activity in man (arsenic, chromium, nickel, iron) are present in the U.S. uranium ores. Their data showed, moreover, no relationship between the number of cigarettes smoked by these miners and the type and duration of uranium mining experience. They considered it, therefore, unlikely that smoking alone accounted for the excess of respiratory cancer among the long term uranium miners.

There is general agreement among several groups of investigators who determined the quality and quantity of ionizing radiation in 371 uranium ore mines of the Colorado Plateau and adjacent regions that in many of these mines the working level of radiation was excessive in many mines and in some highly excessive (Holaday *et al.*; Archer and Simpson; Governors' Conference; Torrey and Jacoe; Morrell; Tsivoglou and Ayer; Miller, Holaday and Doyle). In 1959, thirty-three per cent of the samples taken of the mine atmosphere had concentrations of less than one time the accepted working level of tolerance; 22 per cent had between 1 and 3 times the working level; 23 per cent had between 3 and 9 times the working level, and 22 per cent had concentrations of more than 10 times the working level. The primary hazard involved in mining uranium arises from the alpha emitters, Ra_A, and RaC'.

While Neumann and Allecio, Welford and Morse proposed to use the amount of urinary uranium excreted in the Friday urine as a measure of exposure hazard, Stetzer and Hursh recommended that urinary polonium might serve as a rough measure to estimate the cumulative lung exposure to radon and its daughters. They mentioned in this connection that the radon daughters decay to lead^{210}, a lead isotope with a long effective half-life in the body and a decay scheme producing polonium^{210}. Holaday *et al.*; Aurand *et al.*; Shapiro; and Jech devised methods for determining roughly the radioactive dose, i.e., radon decay products retained in the lung, from tests on exhaled air.

Because of the role which a radioactive type of lead assumes in determining these carcinogenic exposures of uranium ore miners, it may be mentioned that Black in 1943, raised the question of a possible lung cancer hazard for lead miners, smelter workers, lead solderers, plumbers, and members of many other occupations having contact with lead dust and fumes, because he observed lung cancers in two lead workers which developed many years after cessation of exposure to lead. Black pointed out in support of his claim that commercial lead contains radium D and is the most radioactive of all common metals. Its radioactivity was said to vary with the ore from which lead is obtained and with the age of the lead (Black). It is uncertain, however, whether this claim is valid since Dingwall-Fordyce and Lane reported in 1963 that lead workers seem to have a slightly substandard mortality rate from cancer of all sites. This renewed interest in a potential carcinogenic effect of lead on man was generated in part by the observation that lead fed to rats will cause carcinomas of the kidney (Zollinger; Boyland, Dukes, Grover and Mitchley; van Esch, van Genderen and Vink; Kehoe *et al.*). It is not likely that the excessive incidence of lung cancer among English boiler scalers is attributable to the 5 per cent of lead contained in the ash of the creosote-pitch fuel often used (Sherwood and Bedford).

Information is lacking whether more than one of the American uranium ore miners who developed lung cancers have received compensation (McAdams), although the existence of causal relations to their job specific exposure to ionizing radiations is recognized (Ingram; Lisco).

No official data are available as to the occurrence of lung cancers among the uranium ore miners of Katanga, Canada, and the U.S.S.R. (Jacobs; Warschowski; Editorial).

CAPCO KIN 0000142

γ) Lung Cancer Hazards for Employees of Uranium Ore Refinery, Radium Laboratories, Nuclear Installations and Power Plants and Similar Establishments

Epidemiology. Individuals employed in uranium ore mills become exposed to fumes and dust of uranium, which is an alpha emitter. The radioactivity (alpha particles) of uranium presents its greatest hazard when the material is present as an insoluble compound, and lodges in the lungs for a long time (Harris and Kingsley). Uranium is the basic fuel of the nuclear reactors. It occurs naturally or artificially in various isotopes (U 233, U 234, U 235, U 238 and U 239). U 239 decays to plutonium 239. It has been claimed that so far no significant ill effects which could be attributed either to the chemical or radioactive toxicity of uranium have been seen in humans in personnel employed in nuclear energy installations (Harris and Kingsley). Whether the same holds true for workers employed in uranium refining plants, however, remains to be determined. Without any doubt such workers had at least ten years ago, definite and considerable exposure to uranium dust and fumes because of lack of any significant protective measures (Hueper). The actuality of these conditions is well illustrated by pictures contained in an article by Doyle. That metallic uranium when parenterally introduced into rats is capable of inducing cancers was shown by Hueper, Zuelle, Link and Johnson.

A similar absence of incriminating evidence concerning the presence of an occupational respiratory cancer hazard in nuclear reactor facilities is implied by reports published on this aspect although poor ventilation design in some such plants has been admitted (Hilb). Emission of radioactive matter from the reactor stack causing atmospheric radioactive contamination resulting therefrom has been observed (Lowry; Geller, Wordin, Cassidy and Bartholomew). It is remarkable that Love in 1951 noted from a survey of an atomic pile site that a much higher than expected incidence of primary lung carcinoma prevailed at the Brookhaven National Laboratory. He claimed, however, that this phenomenon was not attributable to any occupational radiation exposure. Mottram and Holland made in 1949, a similar observation for the employees of the Oak Ridge installation and proposed that this finding merely reflected the normal trend in lung cancer rates.

Since at the time of the two reports all atomic energy installations had been operating for only a few years, it is unlikely that lung cancers among the employees of such establishments could justly be attributed to occupational factors at that time.

The respiratory radiation hazards related to such industrial activities resemble in many respects those associated with the burning of radioactive wastes in incinerators of institutions, laboratories, hospitals and related establishments and the operation of batteries of radioactive static eliminators (Macchi and Geyer; Comly, Perry and Schwartz; Berman and Ehrlich). Whether such atmospheric environmental pollution with radioactive wastes constitutes a respiratory cancer hazard to the neighbourhood is likewise at present problematical.

Observations made in workers employed in radium factories and laboratories, on the other hand, strongly indicate that radioactive atmospheric pollutants (Sauer; Schlundt, McGavock and Brown; Morris) inhaled by such employees represent the primary causal factor in the development of lung cancers as well as of leukemia in some of them. The occurrence of lung cancer in members of this occupational group was reported by Löwy (2 cases — one of them having also leukemia);

Ireland (1 case), Nefzger (1 case and 3 cases of pulmonary fibrosis (Rajewsky); Seelig (1 case). Baader, moreover, received information on four cases of occupational lung cancer in workers employed in Belgian radium ore refineries. It is obvious from this evidence that radioactive respiratory cancer hazards extend from the miners to the millers of uranium ores.

No information is available at this time whether the bathing in radioactive water practiced for the alleged protection and restoration of health in Germany, Bohemia and the U.S.A. and associated with an inhalation of radioactive mist and gas, consti-

Fig. 46. Carcinoma of the maxillary paranasal sinus on a luminous dial painter (courtesy of Dr. Asa)

tutes an effective lung cancer hazard (Lange; Neitzel; Sisi; Bergonié; Hueper) although the drinking of such water has caused in some individuals radiation sarcomas of the bone (Hueper).

While the pulmonary cancer hazard related to the introduction of radioactive material into the lung is well known, considerably less attention has been given to the fact that occupationally inhaled radioactive chemicals or their direct injection for therapeutic or diagnostic purposes (thorium dioxide) into the paranasal sinuses also has been followed by the development of carcinomas of the paranasal sinuses. Such cancerous reactions have been observed in five former luminous dial painters (Martland; Asa, Evans, Humeltenberg and Martland; Hasterlik, Miller and Finkel) (Figs. 46 and 47) as well as 5 patients receiving thorotrast injections into the maxillary sinus (Hueper; Tuttle; Gross; Faulkner and Keating; Bina, Comsley and Rainbow). The latent period of these radiation cancers which were squamous cell carcinomas, was from 15 to 20 years.

CAPCO KIN 0000143

A successful production of maxillary sinus carcinomas (squamous cell carcinomas) in rhesus monkeys which received intrasinusoidal implants of Ag^{110} and Co^{60} was reported by MELNIKOV. These observations demonstrate that various parts of the respiratory tract are capable of reacting with the development of cancers when adequately exposed to ionizing radiations.

The validity of this statement is further attested to by several observations on the occurrence of lung cancer in patients following a diagnostic parenteral injection of

Fig. 47. Squamous cell carcinoma of the maxillary sinus (above)

thorotrast (FRUHLING, GROSS, BATZENSCHLAGER and DORNER). Bronchial carcinomas have been seen many years after a bronchographic examination entailing an intrabronchial introduction of thorotrast by ROTH and by VÖGTLIN *et al.*, while five additional such cases were reported after an angiographic use of thorotrast by HACKENTHAL; ABRAHAMSON *et al.*, HOLTHUSEN; BATZENSCHLAGER; and NIELSEN and KRACHT. Although there exists scarcely any doubt concerning the existence of causal interrelations for the two carcinomas developing after an intrabronchial introduction of thorium dioxide, such associations are less sure for the carcinomas of the lung following an intravascular injection of this agent. It must be pointed out, however, that reliable experimental evidence demonstrates that various colloidally dispersed particulate or macromolecular materials intravenously injected are retained in the capillaries of the lung. A part of such matter is subsequently excreted into the alveolar lumens enclosed in histiocytes (HUEPER). This process has been observed also following an intravenous injection of thorotrast. Since the decay of thorium dioxide is associated with the production of alpha-, beta-, and gamma-radiations the basic conditions exist in such cases for an ultimate development of pulmonary cancers.

Reports in the medical literature indicate that such cancerous responses to radiations have lately been observed also in other parts of the respiratory system, especially the larynx, in an appreciable number of patients who received some 20 to 40 years previously, x-ray treatments to the neck for malignant and non-malignant diseases, particularly those affecting the thyroid (HOLINGER and RABBETT; KING *et al.*; GOOLDEN; MAJOROS, DEVINE and PARKHILL; VAN NIEUWENHUYSE; JACQUES; VON LICKEN; GARRETT).

A similar potential connotation is attached to the development of fibrosis of the lung following an occupational and, especially, a therapeutic exposure of the chest to large doses of x-radiation, emitted by radioactive chemicals as well as from x-ray tubes (DOENECKE; IRMSCHER; TONGES and KAEBFLEISCH; BELT; WARREN and GATES; WARREN; HAMPERL; BAUDISCH; CHU, PHILLIPS, NICKSON and MCPHEE; FLEMING, FIEBEE and WIERNIK; BAUER and SCHRAER; FREID and GOLDBERG; BERGMANN and GRAHAM; LOUGHEED and MAGUIRE). In only one of these cases of chronic radiation pneumonia with fibrosis present in a worker inhaling radioactive industrial dust of a FISCHER-TROPSCH process did the histologic examination reveal an initial carcinoma after an exposure free interval of 18 years (IRMSCHER). In none of the many hundreds of persons who developed this radiation pneumonitis after the administration of x-radiation for malignant conditions of the chest, especially carcinoma of the breast, on the other hand, has so far been seen a secondary cancerous development. It is not unlikely, however, that the great majority of these persons of usually adult age succumbed to their primary disease long before the latent period for radiation cancers of the lungs had elapsed.

Corresponding time relations may account likewise in part for the present absence of reliable observations on a causal relation between an inhalation of atmospheric radioactive pollutants and a delayed development of pulmonary cancers in members of populations most severely exposed to such carcinogens, since these usually act in a greatly reduced concentration, and, therefore, presumably require a much longer latent period for cancerous reactions to appear than that observed in uranium ore miners for cancer of the lung (mean value about 19 years) (DUNHAM; MEDICAL RESEARCH COUNCIL, 1956; 1960; EISENBUD and HARLEY; LOCKHART; TAJIMA and DOKE; CARMICHAEL and TUNNICLIFFE; SIENKO and COCCONI; SETTER; ZIMMER, LICKING and TABOR; DAWSON; HUBER; WEGST; PELLETIER and WHIPPLE; HOLLISTER). In assessing the potential carcinogenic significance of such exposures to the human lung, it must be emphasized that the absolute amounts entering the respiratory tract from such sources is very small when compared with the quantity of radioactive matter introduced into the lung from the various occupational activities cited. If such environmental radioactive atmospheric exposures should be effective in man, it must be supposed that because of the prospective very long latent period, only those individuals may develop some 40 to 50 years hence lung cancers who were in their early youth when being exposed. At the present, any incriminating claims represent for these reasons, mere speculations based on factually unfounded suppositions and dealing with possibilities. These, nevertheless, because of the general evidence available on such matters, deserve serious consideration.

CAPCO KIN 0000144

Experimental Carcinogenesis. The large amount of human evidence concerning a carcinogenic action of ionizing radiations on the tissues of the respiratory system has received lately ample support from experimental observations.

The production of cancers of the lung in experimental animals (mice, rats, dogs, rabbits) by radioactive chemicals, intratracheally, intrabronchially, intravenously or intrapulmonarily introduced has successfully been accomplished with a variety of such agents by an appreciable number of investigators (WARREN and GATES;

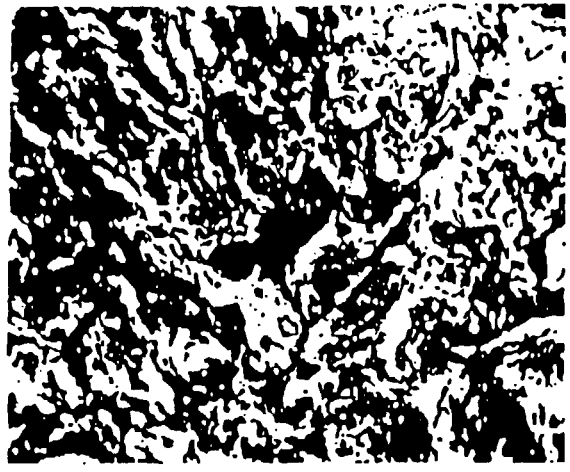


Fig. 48. Immature cell carcinoma in the lung of a rat intratracheally insufflated with radioactive cerium (courtesy by Dr. Cameron)

WILLARD, MARKS and BAIR; ALTMANN, HUNSTEIN and STUTZ; CEMBER, WATSON and NOVAK; CEMBER; PARK, BAIR and CLARKE; GUIMARAES, LAMERTON and CHRISTENSEN; CEMBER and STEMMER; KOCHETKOVA, AVRUNINA and SAGAIDAK; LASKIN, KUSCHNER, NELSON, ALTSHULER, HARLEY and DANIELS; KOTSCHETKOWA and AWRUNINA; KUSCHNER; KURSHAKOVA and IVANOV). The following radioactive chemicals were used in these experiments: Cobalt[60]; Strontium[90]; Plutonium[240]; Ruthenium[106]; Yttrium[90]; Cerium[144]; Sulfur[35]; Phosphorus[32]; Gold[198]; Iron[59]; and Rhodium[106]. The bronchial carcinomas produced were usually squamous cell carcinomas and undifferentiated carcinomas (Fig. 48). While these experiments provided ample proof of the fact that pulmonary tissue when exposed to various types of ionizing radiation, reacts with the development of bronchogenic carcinomas, they did not duplicate the type of exposure to radioactive matter present in man.

The results obtained when such chemicals were inhaled as a gas or dust must be considered of possessing more conclusive value.

In the first experiments of this type reported, SCHMIDTMANN failed to elicit any epithelial bronchial proliferations in experimental animals exposed to the inhalation

of dust of 6 drill holes from Schneeberg mines. Attempts of ROSTOSKI and SAUPE to induce lung cancers in mice inhaling radium emanation (radon) were unsuccessful because of an early death of the mice. DÖHNERT, who exposed white mice to the mine gases and dust by keeping them within the Schneeberg mines noted that after one year in the mines, seven (7) of the 26 mice histologically examined had pulmonary tumors (25%), of which two (2) were diagnosed as papillary adenocarcinomas. Since some strains of white mice develop spontaneously lung adenomas in a much higher percentage of older animals, the significance of these findings is doubtful. However, some support for suggesting causal relations between exposure and lung tumor formation may be deduced from the results obtained by CAMPBELL who exposed mice to the inhalation of dust from Joachimsthal mines and noted that tumors of the lung were present in 20.3% of the test series, while they were found in only 2.1% of the untreated controls. Similarly positive observations were subsequently reported by RAJEWSKY, SCHRAUB and KAHLAU and by KAHLAU, who exposed mice to the inhalation of radium emanation and noted the presence of many pulmonary adenomas and adenocarcinomas in these mice. However, the experimental conditions used, particularly the employment of a non-inbred strain of mice and a relatively small number of mice, impair the value of their observations. It must be mentioned, however, that experimental studies of UNNEWEHR on mice inhaling radon yielded similar neoplastic responses in the lung, i.e., the development of bronchial carcinomas. LISCO and FINKEL, moreover, reported similar results when animals inhaled an aerosol of radioactive cerium (Ce^{144}).

Finally, it may briefly be mentioned that mice given either gamma radiation emitted from radium or x-radiation over prolonged periods of time exhibited an increased number of pulmonary tumors (LORENZ, ESCHENBRENNER, HESTON and DERINGER; LORENZ, HESTON, ESCHENBRENNER and DERINGER; ESCHENBRENNER and MILLER; LORENZ; HESTON, LORENZ and DERINGER). The results obtained in guinea pigs and rabbits simultaneously and identically exposed to two types of radiations, however, were equivocal.

12. Miscellaneous Respiratory Carcinogens

In addition to the different recognized or strongly suspected human respiratory carcinogens of occupational and/or environmental significance, there exists a group of chemicals which either have shown such properties when introduced into experimental animals only and for which so far any corresponding experience in man is lacking — although man becomes, for various reasons, exposed to these agents — or have exhibited carcinogenic qualities for other organs in experimental animals, while a few isolated observations in man suggest that they may elicit cancers of the respiratory tract in this species. The evidence on these chemicals is presented so as to alert all interested parties in such potential relationships, to stimulate intensified study of these chemicals, and to provide whatever basic information is available on the carcinogenic action of these chemicals which may be valuable for any medicolegal purposes. The observations cited, though representing mere clues of possible respiratory cancer hazards, are nevertheless important since the discovery of the majority of the presently known occupational cancers has resulted from further studies of such filamentous evidence.

CAPCO KIN 0000145

a) Isonicotinic Acid Hydrazide (Isoniacid)

During the first decades of this century, tuberculous scars of the lung were regarded by many investigators as a cause of pulmonary cancer developing on the basis of a derailment of regenerative processes in the adjacent lung tissue (Hueper). This concept became distinctly less popular after 1930 following the discovery of specific chemical carcinogens and with improvements in the epidemiologico-statistical methods of analysis. During the past decade, however, a definite revival in the scientific interest of causal connections between pulmonary tuberculosis and lung cancer has occurred. In fact, the concept of a scar cancer of the lung has again found wider acceptance (Roessle; Carroll). Roessle proposed that cancer formation at such sites was attributable to the carcinogenic action of the accumulated cholesterol.

Balo has reported, moreover, on the development of atypical epithelial proliferations and of lung cancers in the marginal areas of old infarcts, while Pansa and Mollo have observed similar abnormal epithelial growth in the lungs of rabbits following the experimental production of hemorrhagic infarcts. These lesions were suggestive in their morphologic characteristics of early carcinomatous changes.

Recent experimental findings of Stanton and Blackwell have thrown additional light on the possible causal mechanism operating in the development of the so-called "scar" cancers of the human lung. These investigators injected intravenously into rats a mixture of a halogenated hydrocarbon (hexachlorotetrafluorobutane), which causes the development of multiple infarcts in the lung, together with a carcinogenic hydrocarbon (methyl-cholanthrene) and observed invasive epidermoid carcinomas derived from regenerating epithelium in the periphery of such infarcts. If methyl-cholanthrene was given in tricaprylin which does not produce infarcts, the development of massive keratinized cysts in the lungs only were obtained which, however, did not become cancerous. While Stanton *et al.* assumed that the regenerative epithelial proliferation elicited by the process of infarction played an important role in determining the cancerous sequelae induced, it is more likely that the infarcts with their interrupted vascular supply served as localizing and concentrating mechanisms for the carcinogenic chemical and that thus the carcinogenic effects associated with infarction reflect actually a quantitative dose phenomenon affecting circumscribed parts of the lung. The histologic observation made by Hueper on the preferential accumulation of oil droplets around scars, tubercles, bronchopneumonic foci, and similar areas with interrupted blood supply and blocked vascular lumen of the pulmonary system of man following an intravenous injection of camphorated oil strongly suggests this action mechanism. The lack of cancerous transformation of the frequently occurring squamous-cell metaplasias with cyst formation in the lung of old rats with chronic pneumonic conditions, on the other hand, attest to the fact that squamous-cell metaplasia of the bronchial epithelium as such is not necessarily a precancerous condition.

Associated with this recent change in the reaction toward the existence of causal relations between pulmonary subpleural scarring and the subsequent development of lung cancer has been the appearance of numerous reports on the frequency of coexistence of pulmonary tuberculosis and cancer and on the suspected causal relations between the two conditions (Crinquette and Hamel; Gebel, Feyerin, Fuhrmann and Sparger; Bodenstab and Quarz; Wolford, Webb and Stains; Southgate; Kahlstats, Hermann and Heim). Tonelli, however, has recently challenged the validity

of such claims by pointing out that the so called scars are pleural depressions, not preexisting to the tumor but caused by it. They, moreover, do not correspond to previous infarcts, are not tubercular and occur mostly in persons 40 to 50 years old.

Despite these criticisms of Tonelli it may nevertheless be possible that the increased interest in the association between pulmonary tuberculosis and cancer reflects at least in part, a real and recent change in the therapeutic management of pulmonary tuberculosis which is related to the introduction of chemical tuberculostatic agents, especially isonicotinic acid hydrazide (isoniacid).

Experimental observations made by several investigators during the past decade have shown that isoniacid is a chemical carcinogen to mice in which it is capable of producing benign and malignant tumors of the lung as well as cancers in other organs (Jonasz, Balo and Kemoldt Vialetto and Casanova; Schwan, Mori, Yasuno and Matsumoto; Bianchedi and Ribaccioli). Furui, Negata, Imamura and Tagashira have drawn attention to the fact that, according to Mori *et al.*, compounds capable of inducing pulmonary tumors in mice (isonicotinic acid hydrazine, ethyl carbamate, semicarbazid, pyrazinamide) have a remarkable similarity of their molecular structure in containing a carbamyl group ($NH_2-\overset{\overset{O}{\|}}{C}-$).

While it is possible that the two developments cited are merely chronologically related, the fact that the tuberculostatic chemical, isoniacid, is a pulmonary carcinogen nevertheless suggests that there might exist a causal relation between the two events, and that the therapeutic use of isoniacid in patients with tuberculosis of the lung may have played an active and essential part in the subsequent development of pulmonary cancer in some of them. The evidence on hand in support of such a hypothesis deserves to be tested for its validity through conducting a critical analysis of all cases of lung cancer in tuberculous individuals whether or not they had been treated with isoniacid or any other tuberculostatic chemical and whether the quality and quantity of the chemical used as well as the latent period and any other circumstantial evidence point to the existence of a relation between the treatment given and the following pulmonary carcinogenesis.

The potential occupation significance of these experimental observations is suggested by the fact that hydrazines are employed as rocket propellants and oxidizers in the production of which the carcinogenically highly potent nitrosamines are used (Boyden).

b) Nitrosamines

Nitrosamines are compounds frequently used in or generated during chemical processes of industrial importance since nitrosamines are formed when dialkylamines are acted upon by nitrous oxide or nitric acid (Druckrey, Preussmann and Schmähl). The rocket propellant, dimethylhydrazine, thus is a reduced derivative of dimethylnitrosamine (Boyden; Argus, Leutze and Kahn; Argus and Hoch-Ligeti). While so far no human observations are on record indicating that any one of the various nitrosamines found to be carcinogenic for mice, rats, guinea pigs and hamsters exerts a similar action on man, Druckrey has suggested that such chemicals might be contained in cigarette smoke and thus account for some of the carcinogenic properties exhibited in animals by cigarette tar.

CAPCO KIN 0000146

The following experimental observations demonstrate the high carcinogenic potency of nitrosamines and specifically their carcinogenic action on the trachea, bronchi and alveolar structures of the lungs and nasal mucosa of animals (Druckrey, Preussmann and Schmähl; Schoental; Dontenwill and Mohr, Argus and Hoch-Ligeti; Druckrey, Preussmann, Schmähl and Müller, Schoental and Magee; Druckrey and Preussmann; Zak, Holzner, Singer and Popper; Dontenwill, Mohr and Zagel; Herrold and Dunham).

Although the various nitrosamines differ among each other in their organotropic carcinogenic action (liver, stomach, esophagus, trachea, lung, kidney, bladder, brain) depending upon their chemical constitution and the particular species used, many of them induce the development of squamous cell carcinomas and adenocarcinomas of the trachea and bronchi and alveolar carcinomas of the lung (dimethylnitrosamine, diethylnitrosamine, N-N-diamylnitrosamine, N-nitrosopiperidin, N-nitrosomorpholin, N-nitroso-N-methyl-urethane). The relatively high cancer attack rates, the remarkable organ specificity of some of these chemicals and the organic and species pluripotentiality of some members of this group of chemical compounds indicate their potential importance as possible human carcinogens. The experimental observations on hand are sufficiently serious and adequate for justifying thorough investigations of occupational and general population groups specifically exposed to these chemicals or their reduction and oxidation products. While the reduction product, dimethyl hydrazine, has proved to be noncarcinogenic, the oxidation product, dimethylnitramin, when fed to rats has produced kidney cancers.

c) Nitroquinolines and Related Nitro- and Amino Compounds

Another potential human respiratory carcinogen is 4-nitroquinoline 1-oxide, which was developed as a fungicide (Ura, Bognar and Beres; Nakahara). This chemical and some of its nitro- and aminoderivatives induce when applied to the skin, squamous cell carcinomas, and sarcomas when injected subcutaneously into mice and rats (Takayama; Shirasu and Ohta; Shirasu; Nakahara and Furuoka; Nakahara, Furuoka and Sakai; Endo and Kumi; Cimino; Lacassagne, Buu-Hoi and Zajdela) Subsequent studies yielded the fact that mice subcutaneously injected with this chemical developed also benign and malignant epithelial tumors (adenocarcinomas) of the lung (Mori; Mori and Yasuno). It is noteworthy that similar neoplastic responses in the lungs were evoked in mice when they were painted, with, or inhaled parabenzoquinone (Hatashi, Kanizawa and Iur; Takizawa; Takizawa and Kanizawa; Kishizawa).

The administration of acetylaminofluorene to rats, but not to hamsters, has also resulted in the development of bronchial carcinomas (Bielschowsky; Dontenwill, Mohr and Zagel), and N,N'-2,7-fluorenylenebisacetamide has been shown to induce cancers of the lung in rats in addition to cancers of the liver, mammary glands, glandular stomach, jejunum, ear duct, uterus, skin, salivary glands, kidney, cranial nerves, adrenal cortex pancreas and hematopoietic tissues (Morris; Wagner; Ray, Stewart and Snell). A comprehensive experimental and epidemiologic investigation of aromatic and aliphatic amino- and nitro-compounds for carcinogenic properties exerted on tissues of the respiratory system of man and animals is urgently needed as a part of the general study on the etiologic factors responsible for the causation and rise in frequency of cancers of the lung in man. Such investigations are especially indicated for the large group of aromatic amino- and nitro-chemical workers, because Ulrich and Pleschner noted not only an excessive incidence of bladder cancer but also of lung cancer among Swiss benzidine workers.

d) Carbamates

The tumorigenic action on various tissues, especially the lungs of mice and rats by ethyl carbamate (urethane) and the demonstration of this effect in the offspring of mice which received urethane during the last stage of pregnancy (Nettleship and Henshaw; Larsen and Heston; Larsen; Haddow and Sexton; Schoental; Fiori-Donati; Reiman; Mossuti and Larsen; Berenblum and Haran-Ghera; Kelin; Jaffé; Cuyer and Claus; Rosin; etc.), has given rise to speculations whether or not the use of urethane and other carbamates in medicine and in the various chemicals widely employed as pesticides, insect repellents, and herbicides (Ball and Cowin; Bartalini; Shabad and Naumova; Eskola; Kyle, Schwartz, Oliner and Damelstuk; Cramer) might have played a role in the rise of lung cancers during recent decades (Bacq). This suspicion received lately some support by the fact that ethyl carbamate and isopropyl-n-phenyl carbamate (van Esch, van Genderen and Vink) were shown to be carcinogenic initiators and capable of producing cancers of the skin, liver and other internal organs of mice (Tannenbaum). A weaker neoplastic effect upon the mouse lung was demonstrated for several closely related carbamates (propyl carbamate; N-methylethylcarbamate; N-hydroxy-ethylcarbamate) (Furui, Nagata, Imamura and Tagashira). The production and use of polyurethane plastics in the human economy have recently created another source of widespread contact of occupational and general population groups to polymerized carbamate derivatives which have been found to be carcinogenic when implanted into rats (Hueper and Payne). The incriminating experimental evidence on hand is sufficiently serious for justifying the following investigations:

1. Surveys on the occurrence and incidence of cancers of the respiratory system, especially the lung, should be conducted among producers and users of carbamate pharmaceuticals, pesticides, herbicides and insect repellents for establishing factual evidence on the neoplastic action of such compounds in man.

2. Similar epidemiologic surveys should be made on worker groups engaged in the production and processing of polyurethane plastics especially where fumes and dusts from such products are inhaled.

e) Chlorinated Hydrocarbons

Chlorinated hydrocarbons are mainly known for their toxic effect upon the liver in man and animals and for their hepatocarcinogenic action in mice, rats and hamsters (chloroform, carbon tetrachloride, DDT, Aldrin, Dieldrin, Aramite) (Edwards and Dalton; Della Porta, Terracini and Shubik; Rudali and Mariani; Eschenbrenner and Miller; Stowell, Lei, Tsubio and Yamasana; Fitzhugh and Nelson; Davis and Fitzhugh). Another Lan, moreover, has recently demonstrated that DDT, methoxychlor, Rothane (dichloro-diphenyl-dichlorethane) and Kelthane (Di-p-diphenyl trichlor-ethanol) like the carbamate insecticide, Sevin (1-naphthyl-N-methyl-carbamate), when applied to the invertebrate, Turbellaria or Tricladida, elicit abnormal cell growth of the epidermis and tumor formation.

CAPCO KIN 0000147

The observation of a cancer of the lung in a laboratory technician, 24 years old, who had worked with DDT for nine years previously (Radomski) and in a chemist entomologist who had been engaged for a number of years in the development of DDT preparations (Hueper) suggest the possibility that these hepatocarcinogenic agents when inhaled in sufficient quantities over an adequate length of time might exert also a carcinogenic effect upon the respiratory organs. For this reason, it seems to be advisable to undertake epidemiologic studies on producers and the industrial and agricultural users of chlorinated hydrocarbons inhaling these chemicals in the form of dust, mists, suspensions and gases sustaining identical types of exposure for their relative liability to cancer of the respiratory organs.

f) Formaldehyde

Since formaldehyde is a mutagen (Auerbach) and because Carruthers and Schabad (1935) produced atypical proliferations of the bronchial epithelium in mice following the introduction of formalin, the suspicion has prevailed that the inhalation of formaldehyde vapors might lead to the development of lung cancer in man (bakelite makers, undertakers, histologic technicians, wrinkle proofers of clothing, etc.) (Fisher, Kanop and Biondi; Glass; Henson; Lutz; Bourne and Seligman). Some experimental support of such a suspicion may be deduced from observations of Watanabe and Sugimoto, who obtained subcutaneous sarcomas in rats following the subcutaneous injection of urotropin, a formaldehyde releasing urinary antiseptic. Experiments of Horton, Tye and Stemmer who subjected mice to the inhalation of gaseous formaldehyde, did not result in the production of pulmonary tumors although the tracheal and bronchial mucosa of such animals showed hyperplastic and atypical metaplastic changes which, however, did not progress to an invasive cancer. In contrast, some of the mice subjected to repeated inhalation of an aerosol of coal tar developed squamous cell cancers of the bronchi. Formaldehyde vapors applied simultaneously with the inhalation of aerosol of coal tar did not hasten or potentiate tumor formation in the lung.

There is not sufficient experimental and human epidemiologic evidence indicating that exposures to formaldehyde vapors constitute a significant and actual lung cancer hazard.

g) Natural and Man-Made Polymers

Several isolated observations suggest that an occupational and habitual inhalation of various natural and man-made carbon polymers might causally be related to the development of cancer of the lungs. The coexistence of bagassosis and lung cancer was reported by Onuigbo. Kotin and Falk recorded two cases of lung cancer in workers exposed to fiberglass and plexiglass dust or fumes generated during the synthesis and manufacture of these products. Fragments of the polymers were present in the tumor tissue. Breslow, studying the role of different occupational factors in pulmonary carcinogenesis, found that deep-fat frying cooks had a statistically excessive liability to lung cancer. It may be of significance that fatty acids undergo polymerization when subjected to high temperature and oxidation and that such fats contained material which when injected into rats displayed carcinogenic properties. The demonstration of carcinogenic qualities in various aliphatic diepoxides when applied to the skin of mice furnishes additional evidence that polymerization products might be involved in the cancerization process elicited by some chemicals since diepoxides exhibit a tendency to polymerize and to influence the degree of polymerization of chemicals with which they come in contact (Hendry, Homer, Rose and Walpole; Weil, Condra, Haun and Strigel; Orris, van Duuren and Nelson; Hine, Guzman, Coursey, Wellington and Anderson; Kotin and Falk). Since Hine *et al.* found in tests on animals that two epoxy-resins possessed carcinogenic properties, it may be pertinent to point to the excessive attack rate of lung cancer in painters (Pipes; Wynder). Mention also may be made in this connection of the local and systemic carcinogenic effects elicited in rats by parenterally introduced carboxymethyl cellulose, polyvinyl pyrrolidone and several dextrans (Nelson; Hueper), since these and similar water-soluble polymers are widely used as active ingredients in hair lacquers and have induced in some individuals (beauticians especially) multifocal granulomatous reactions in the lungs (Edelston; Bragmann, Flance, Cruz, Klam, Atkinson, Josin, and Blumenthal; Brunner, Giovacchini, Wyatt, Dunlap and Calandra; Bergmann; Baumler; Draize, Nelson, Newburger and Kelly; Dean; Doyle; Cahn).

1. The spreading practice of deep-fat frying for commercial and home purposes and the thereby conditioned exposure of cooks, kitchen personnel and housewives to fumes and mists of repeatedly heated and oxidized fats which have undergone polymerization, provides an urgent indication to survey employees of commercial deep-fat frying operations for their relative liability to cancers of the respiratory organs.

This type of respiratory exposure may also be present as a part of the carcinogenic hazards connected with charcoal broiling of meats and fish, although the major part of carcinogenic exposures is probably connected here with the inhalation of carcinogenic combustion products of coal or wood and of burned meat and fish.

2. Employees in beauty parlors and women and men applying frequently to their hair and without precautions, nebulized hair lacquers furnish another group of people in need of comprehensive and critical epidemiologic analysis for occupational and habitual lung cancer hazards.

3. A third class of individuals who should be analyzed in this direction are the large and diverse groups of industrial producers, processers, and users of water-soluble and insoluble, solid and liquid plastics inhaling dusts, fumes, and mists of various natural and man-made polymers and developing in part as the result of such exposures, irritations of the lung (chemical pneumonia) or pneumoconioses.

D. Prevention and Control of Occupational Respiratory Cancer Hazards

The evidence presented establishes definitely the fact that numerous man-made and man used respiratory carcinogens have been introduced into the human environment during the past 150 years and that they are responsible not only for a rapidly growing number of occupational cancers of the lung, pleura, larynx, nasal cavity and paranasal sinuses, but evidently also play a significant role in the causation of such cancers in the general population through their direct or indirect, local and general

CAPCO KIN 0000148

spread into the atmosphere, especially of urban and industrialized regions. Since cancers of the respiratory system are still among the least therapeutically controlled malignant tumors and have alarmingly increased in frequency during the last 60 years, they represent an important problem for applied cancer prevention.

A practical approach to occupational respiratory cancer control by preventive and prophylactic measures has to include two aspects representing different problems of technology, public health, and law. The primary, but not always principal hazard affects the various types of workers engaged in the production, processing, handling, transportation, shipping, consuming and using of such carcinogenic materials. It is obvious that this group of workers includes often a considerable number of individuals who are not ordinarily and readily suspected of having such contacts. Many of them, moreover, are being exposed to such agents while working either on other jobs within the plant area or while handling such products, usually intermittently, in transit (stevedores, truckers, shipping clerks, laundresses, salesmen, delivery men, etc.) There can be little doubt that under ordinary circumstances, occupational exposures to respiratory carcinogens go often unnoticed for the last group of individuals listed. They are usually also not subjected to any control measures. Cancers resulting from such contacts for these reasons do, as a rule, not become causes of compensation procedures even if existing occupational compensation laws would apply to occupational diseases contracted under such circumstances.

The second and often much larger group of individuals exposed to occupational or industrial respiratory carcinogens, comprises the persons who have contact with these agents following their dissemination in the immediate environment of industrial establishments (fume zone), i.e., persons who work, live, play or attend school near such plants and later in life and often after a lag period of many years, develop the so-called "neighborhood cancers". A variety of these cancers are represented by those which occur in individuals living or working near the roads of transportation of carcinogenic materials and inhale, therefore, the dust from roads accidentally contaminated with such materials or reside along roads paved with slags containing carcinogenic residues (asbestos, radioactive chemicals, nickel, etc.) An additional group of persons having environmental exposures to respiratory carcinogens consists of members of the household of workers who have occupational contact to carcinogens and who bring home their dusty and dirty work clothes for cleaning, and thereby spread contact with such carcinogens to other members of the household ("household cancers"). The definite demonstration of such respiratory "neighborhood" and "household cancers" is of rather recent date and has remained limited essentially to only two types of carcinogens (beryllium, asbestos). Their recognition was facilitated by the fact that these carcinogens produce pulmonary changes of etiologically characteristic nature. While the environmental dissemination of respiratory carcinogens has been made the subject of some control legislation, it is doubtful whether any number of these cancers appearing in members of the general population from such events has ever been made the subject of litigation or of criminal prosecution.

A preventive control of occupational respiratory cancer hazards can be achieved by either eliminating the carcinogenic agent from the work environment, i.e., by discontinuing its further production and use, or by employing production and handling procedures which preclude any contact of workers with the hazardous material. The practical application of the first mentioned method of control which obviously is the most effective one, encounters often distinct difficulties because of the unavoidable need for many of the carcinogenic products mentioned, such as chromium, nickel, carbonaceous fuel, etc. It is, moreover, obvious that such procedures would always result also in the closure of the plant and thereby in the loss of employment of the workers involved. Safety, therefore, is bought under such circumstances with unemployment through elimination of the hazardous jobs.

A similar result is likely to occur in many instances if hazardous occupational exposures to respiratory carcinogens are controlled by the introduction of safer and more effective technologic production measures. Such procedures usually are associated with the introduction of extensive automation which again results in a reduction in labor force. The use of and insistence on technologic preventive measures against respiratory cancer hazards, as against any other industrial cancer hazards thus create serious social and economic repercussions for the workers employed in such operations. The safety obtained under such circumstances for the workers retained in their jobs is, moreover, rarely absolute. There usually remains some unavoidable degree of hazard for such workers. Unless special precautions are taken, it is also possible that the use of effective preventive measures within a plant may result in a more marked pollution of the periplant environment, i.e., air, soil and water, through a more massive release of plant wastes with exhaust air and waste water. It is obvious from these considerations that also a control of respiratory cancer hazards by technologic means is available only for a price. It is up to human society to decide whether or not it is willing and able to pay the entire price or whether it prefers to make a compromise at some level of partial safety which does not endanger its present economic existence, but which at the same time provides only incomplete and probably not maximally possible safety.

It is apparent, moreover, from the preceding discussion that in any attempt to secure relative protection against occupational and industry-related respiratory cancer hazards, human society is faced with the practical and moral problem that such efforts might result in the substitution of one social inequity by another one and that the enforcement of justice thereby might become a two-faced measure. Any attempt at improving radically this complex situation and to unravel the complicated relationships will confront mankind with the perplexing dilemma of finding new means for promoting progress and prosperity without human sacrifice and for restraining those of its members who continue to adhere to the old principle of dubious morality that the ultimate purpose of organized mankind is the accumulation of physical, monetary assets and not the acquisition of moral values and the protection of the well-being of its individual members as well as of mankind as whole.

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Subject Index

2-Acetylaminofluorene lung cancers 10, 150
Acid workers 7
Air Pollutants, arsenic 31
— —, asbestos 41, 50
— —, 3,4-benzpyrene 27, 81, 94, 112, 114
— —, beryllium 99
— —, carbon black 133
— —, chromium 72, 75, 81, 83
— —, coal tar 113, 114
— —, iron 94
— —, nickel 86
— —, radioactive chemicals 145
Aliphatic epoxides 118
Alkali workers 7
Anthracosis 2
Arsenic 8, 9, 11, 22, 24, 25, 28, 30—38
—, carcinogenic dose 33, 36
— cancer 32
— —, experimental 36
— —, occupations 33—35
— content air 31
— — biologic material 37
— — food 31
— — water 31
— — soil 32
— — tobacco 31
—, occupational larynx cancer 34, 35
—, — lung cancer 33
—, — *paranasal sinus cancer* 34, 35
— poisoning animals 32
Asbestos 8, 9, 11, 14, 22, 23, 38—56
—, anticarcinogenic action 53
— cancers 40, 41
— —, causative mechanisms 55
— —, cigarette smoking 54
— —, age distribution 52
— —, experimental 54—55
— —, latent period 54
— —, sex distribution 53
— —, synecarcinogenesis 54
— carcinoma lung 42—50
— —, *lung, pathology* 47—50
— chrysotile 39, 50
— crocidolite 39, 50
— exposure stigmata 40
— nonoccupational exposures 40, 41
— occupational exposures 40
— products 40
— technologic data 38
— mesothelioma, epidemiology 50—52
— —, peritoneum 39, 40, 41, 45, 50—53
— —, pleura 39, 41, 42, 50—53
— warts 40
Asbestosis 40, 41
—, epidemiology 41, 42—47
Asphalt, native 120
Atmospheric pollutants 12, 23
Atomic energy plants lung cancers 142
Automobile exhaust 123—125

Bagassosis 2, 6
—, lung cancer hazard 152
Benzidin 9, 10, 151
3,4-Benzpyrene air 11, 81, 97, 112, 114
— asbestos cancers 56
Beryl 99, 100
Berylliosis, nonoccupational 100
—, occupational 100
Beryllium 9, 10, 23
—, technologic data 99
— *cancer*, experimental bone 100
— —, — lung 100
— content biologic material 102
—, exposure non-occupational 100
—, — occupational 100
— lung cancer 101
— — —, allergy 102
— — —, beryllium-protein complex 102
— — —, causal mechanism 102
— — —, smoking 101
Boiler scalers 94, 96
Bronchitis, chronic 1, 3, 7

Cabinet makers 7
Carbamate 10, 11
Carbon polymers 11
— —, water insoluble lung cancer hazard 153
— —, *water soluble lung cancer hazard* 153
— black 113, 118
Carnotite 138
Carcinogenic symptom complex 21
Chlorinated hydrocarbons lung cancer hazard 151

Chromates 7—9, 12, 13, 15, 22, 24, 25, 28, 79, 81
Chrome cancer hazards intraplant 59
— — — peroplant 58, 64, 72
— — cancers, clinical aspects 70
— —, chromate producers 57, 59
— —, experimental 68—70
— —, former workers 62
— —, larynx 59
— —, latent period 64
— —, lung epidemiology 59—64
— —, — histologic types 65—70
— —, mesothelioma 65
— —, nasal sinus 59
— —, negroes 63
— pigments 58, 59, 77
— — cancers 58, 59
Chromitosis 68
Chromite ore 57, 60, 76
Chromium 56—85
—, air pollution 83
—, plant air 73, 74, 75
— products 57
—, technologic data 57
—, water pollution 83
— carcinogenesis 80—82
— —, allergy 82
— —, biologic availability 81
— —, fuel products 81
— —, valence 81
— content, biologic materials 70—72
— exposure, nonoccupational 57, 58
— —, occupational 57, 58
— —, stigmata 56—57, 63
— lung cancer, colored workers 75
— — —, experimental 76—80
— — —, medical prophylaxis 84
— — —, prevention 82—84
— — —, smoking 75
Cigarette makers 6
— tar cancers, lung 108
— — —, skin 108
Coal combustion products 107
— distillation products, paraffin 107, 108
— — —, tar oils 107, 108
— economy 108
— miners 7
— pitch 107
— soot 107
— tar, air pollution 113
— — exposure, occupational 108—114
— — fumes 8, 9, 11, 14, 16, 21, 22, 24, 28
— — —, 3,4 benzpyrene content 112
— — oils 107, 108
— —, respiratory cancer hazards 108, 109
— —, technologic data 107
— — workers, larynx cancers 109
Coal tar workers, lung cancers 109
— — —, paranasal sinus cancers 109
— — cancers, experimental 113, 114
— — —, skin 108
— — —, multicentric 112
— — lung cancers, incidence 110
— — — —, *epidemiology* 109—111
Cobalt miners 127
Coke oven workers lung cancer 109—112
Colorado plateau lung cancers 133, 138
Cutting oil additive 125
— — cancers, experimental 125
— oils 118, 119

DDT, lung cancer hazard 152
Diesel engine exhaust 123, 124
Dust, mineral 2
—, vegetable 6

Electrometallurgical workers, lung cancer 113
Epoxides, aliphatic and aromatic 10, 11
Ethyl carbamate, lung cancer 151

Fluorspar miners 131
Food contaminants 12, 23, 31
Formaldehyde, lung cancer hazard 152
Foundry workers 94, 96, 112

Gas house workers, lung cancer 109—111
Gasoline 118
— additive 124
—, oxidized 10, 11
Glass 5
Grain dockers 6

Hair lacquer 12, 158
Hard rock miners 133
Hematite miners 94
Hydrogenated coal oils 118
8-Hydroxyquinoline 12

Iatrogenic carcinogens 12
Infarct, lung 1
Ionizing radiations 125
— — generators 125
Iron, asbestos cancers 55
— -carbohydrate complex 98
—, exposure non-occupational 94
—, — occupational 94, 96
—, technologic data 93
— larynx cancer 96, 98
— lung cancer, 3,4-benzpyrene 97
— — —, causal mechanism 98
— — —, epidemiology 94—96
— — —, experimental 97
— — —, incidence 96
— — —, smoking 96

CAPCO KIN 0000176

Iron oxide 9, 10
— —, carcinogenic carrier 98
— polishers 94
Irritants, industrial 1, 3, 8
Isoniacid 10, 13
—, lung cancer 148
Isonicotinic acid hydrazide 148
Isopropyl alcohol 104—106
— oil 8, 9, 22
— —, chemical composition 106
— —, polymers 107
— —, technologic data 105
— — cancers, epidemiology 106
— — larynx cancer 106
— — lung cancer 106
— — nasal sinus cancer 106
— — respiratory cancers, experimental 107

Larynx cancer 8, 16, 22, 24, 30, 34, 35, 56, 59, 96, 104, 106, 109, 145
Lost see mustard gas 103
Luminous dial painters paranasal sinus cancers 143
Lung cancer, anthracosis 2
Lung cancers, epidemiology demographic distribution 26
— — —, emigrants 26
— —, experimental silica 5
— —, former workers 15, 61, 62
— —, infarct 1, 148
— —, occupational age distribution 24
— — —, attack rates 24
— — —, coal tar workers 109
— — —, epidemiology 14
— — —, exposure period 27
— — —, histologic types 28
— — —, household 21, 23, 100
— — —, intraplant spread 23
— — —, lag period 27
— — —, latent period 27
— — —, medicolegal aspects 15
— — —, neighborhood cancers 23, 41, 72, 81, 100
— — —, nuclear energy installations 142
— — —, radiation workers 142
— — —, radioactive wastes 142
— — —, radium laboratories 142
— — —, regional industries 17, 18
— — —, sex distribution 22
— — —, socioeconomic classes 16
— — —, trades and professions 16
— — —, women 21
— —, pneumoconiosis 2—7
— —, scar 1, 3, 6, 129
— —, silicosis 2—6
— —, traumatic 2
— —, tuberculous scar 148

Mesothelioma asbestos 25, 27, 40, 41
—, chromates 65
Metal ore miners 133
— smelter workers 7
Methylated naphthalene 118
Mineral oil 7—9, 11, 12, 16, 22, 24, 25
— oils see petroleum
Motor exhaust 10
Mustard gas 8, 9, 22
— —, anticarcinogen 105
— —, poisoning 103
— —, technologic data 103
— — cancer, causal mechanism 105
— — —, experimental 105
— — —, larynx 104
— — —, lung 103
— — —, nasal sinus 104
— — exposure, occupational 103, 104
— — —, non-occupational 103, 104
— — respiratory cancer, incidence 104

Negroes, chromium lung cancer 75
Newfoundland, lung cancers 131
Nickel 8, 9, 11, 22
— content, biologic material 90
—, gasoline additive 86, 93
—, technologic data 85
— cancer, experimental 91, 92
— carbonyl 85, 86
— exposure, nonoccupational 86
— —, occupational 86
— —, smoking 86
— larynx cancer 87
— lung cancer, incidence 87
— paranasal sinus cancer, incidence 87
— refinery workers 86, 87
— respiratory cancer, allergy 89
— — —, alkali 88—90
— — —, arsenic 88, 89
— — —, causative mechanism 93
— — —, exposure time 88
— — —, latent period 88
— — —, pathology 89
— — —, prevention 93
— — —, sequential appearance 88
Nitro-olefins 118
Nitroquinolines lung cancer 150
4-Nitroquinoline-1-oxide 10
Nitrosamines 10, 11, 29
—, lung cancer 150
—, paranasal sinus cancers 150

Other miners 97
Oil economy 108
— pneumonitis 121
Oils, vegetable oxidized and polymerized, lung cancer hazard 152

Painters 7
Paranasal sinus cancer 8, 22, 24, 25, 28, 34, 35, 56, 59, 104, 106, 109, 143, 146
Pesticides 6
Petroleum, natural sources 118, 120
—, technologic data 118
— asphalt 118
— oil 118
— —, uses 120, 21
— — cancers, larynx 121
— — —, lung 120
— — —, skin 118
— paraffins 118
— wax 118
— — cancers, man 122
— — —, experimental 122
Pluripotentiality, respiratory carcinogens 21, 29
Pneumoconiosis 2—7
Pneumonitis, chemical 7
Polyetiology, respiratory cancers 29
Polymer cancers, asbestos 55, 56
— —, isopropyl oil 107
Polypropylenes 106
Polyurethanes, lung cancer hazard 151

Quartz 5

Radioactive chemicals 8, 9, 22, 125
— exposures, nonoccupational 126
— —, occupational 126
— fallout 125, 126
— mines global aspects 135
— ore miners 127
— — —, Joachimsthal 137
— — —, New Foundland 133
— — —, Non-Uranium Miners 127
— — —, Rocky Mountains 135
— — —, Schneeberg Miners 127
— respiratory cancer, hazards 126
Radiation cancers 126
— larynx cancers, X-radiation medication 145
— lung cancer, Colorado plateau metal ore miners 133
— — —, Colorado plateau miners incidence 135
— — —, experimental 144, 146
— — —, Joachimsthal miners exposure time 137
— — —, Joachimsthal miners lag period 137
— — —, Joachimsthal miners silicosis 137
— — —, Joachimsthal mines 136
— — —, Joachimsthal mines radioactivity 137
— — —, Joachimsthal radium plant 136
Radiation lung cancers, lead workers 141
— — —, metal ore miners, smoking 135
— — —, New Foundland, age distribution 133
— — — —, fluorspar mine 131, 133
— — — —, incidence 131
— — — —, mine radioactivity 132
— — — —, smoking 133
— — —, non-uranium ore miners 127—135
— — —, Rocky Mountain Uranium Miners, exposure time 139
— — —, Rocky Mountain Uranium Miners, incidence 139
— — —, Rocky Mountain Uranium Miners, smoking 140
— — —, Rocky Mountain Uranium Mines 138
— — —, Rocky Mountain Uranium Mines, radioactivity 140, 141
— — —, Schneeberg, cobalt ore 127
— — — —, exposure time 128
— — — —, inbreeding 128, 130
— — — —, incidence 127, 128
— — — —, mine, radioactivity 129, 130
— — — —, pathology 128, 129
— — — —, silicosis 128
— — —, thorium dioxide medication 144
— — —, uranium ore mines 136
— — — hazards, radioactive water 143
— paranasal sinus cancers, thorium dioxide medication 144
— respiratory cancer hazards, air pollution 145
— pneumonitis X-radiation medication 145
Respiratory cancer, see Lung cancer, Larynx cancer, Paranasal sinus cancer
— —, compensation laws 154
— —, polyetiology 29
— — hazards, control laws 154
— — —, social aspects 155
— carcinogens, classification 9
— —, exposure routes 11, 29
— —, exposure types 12
— —, extrapulmonary cancers 11
— —, nonspecific 1
— —, pattern of dissemination 23
— —, peri- and extraplant spread 23, 41, 50, 58, 59, 75, 81, 86, 94, 100, 112, 114, 123
— —, pluripotentiality 21
— —, potency 24
— —, potential 147
— —, smoking 9, 10, 12—14, 16, 21, 29, 32, 34, 75, 86, 96, 101, 133, 135, 140
— —, specific 7
— —, systemic effects 8, 21, 24, 25
Rubber workers lung cancer 113

CAPCO KIN 0000177

Scar cancer, lung 1, 3, 6
Schneeberg miners, lung cancer 127
Shale oils 118
Shellac pneumoconiosis 6, 7
Siderosis 98
Siderosis, lung idiopathic 94, 97
— — occupational 94
Silastic 39
Silicones 39
Silicosis 2—6
—, anticancerous effect 4
—, hematite miners 4
—, Schneeberg miners 4
Smudge pots 125
Soot 8, 9, 10

Tabacosis 6
Tobacco contaminants 6, 12
— Dust 6
Trauma, lung cancer 2

Uranium economy 108
— ore miners 136—141
Urethane 10, 11

Water pollutants 31, 143
Wax pressers, scrotal cancers 119

X-Radiation, lung cancer 125

Yperite see Mustard gas 101

CAPCO KIN 0000178

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January 12, 1968

Mr. Charles F. Barber
American Smelting and Refining Company
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New York, N. Y. 10005

Dear Chuck:

Please find enclosed clippings from the Nashville paper dated August 6, 1967, August 18, August 22, October 20, October 22, November 8 (2 articles), November 30, early December, December 11, December 12, and December 13, 1967. Also various articles as furnished by J-M, and two articles from Mike Messell to me, all pertaining to the same subject.

As you will see in reading, this thing started out with newspaper publicity reflecting on the people responsible for purchasing pipe in Nashville and all the cancer propaganda apparently came as a direct result of the newspaper attack.

Hoping this will give you a deeper insight into the problems as we see them.

Sincerely,

S. D. Weaver
Vice President & General Manager

SDW/gj
Enclosures

NYO-1/19/68-Copied for: ~~MJMessell~~ - w/encs.
KWNelson " "

Manufacturers of PERMAFLEX Water and Sewer Pipe

CAPCO KIN 0000180

NASHVILLE TENNESSEAN

DECEMBER 12, 1967

12/12/67

Asbestos Pipe, Cancer Tie Hit

NASHVILLE TENNESSEAN

By JIM SQUIRES
Staff Correspondent

NEW YORK -- There is no evidence to support a recent statement by a Nashville doctor that use of asbestos—cement water pipe might cause cancer, a noted cancer researcher said here yesterday.

Dr. George Wright, chairman of The Institute for Occupational and Environmental Health, said he did not think such a relationship "will ever be established."

WRIGHT, HEAD of the department of medical research in internal medicine at St. Luke's Hospital in Cleveland, Ohio, said a letter from Dr. James Snell, an assistant professor at Vanderbilt University school of medicine, suggesting such a relationship "apparently arises out of an incomplete perspective" of the problem.

Wright spoke to nine Metro councilmen here to tour a Johns-Manville plant in Newark, N.J., a manufacturer of asbestos-cement pipe.

Snell sent a letter last month to Metro waterworks director Robert L. Lawrence supporting Lawrence's decision to prohibit asbestor-ce-

(Turn to Page 12, Column 1)

Asbestos Pipe, Cancer Tie Hit

(Continued From Page One)

ment manufacturers from bidding on Metro waterpipe purchases.

The council committee on purchasing had suggested that Lawrence allow asbestos-cement manufacturers to bid because the product is less expensive than the cast iron pipe now being used.

SNELL WROTE that asbestos is a known cause of cancer and can contaminate drinking water. The physician said he did not believe this fact had been brought to the attention of the U.S. Public Health Service.

Wright, an adviser to the U.S. Public Health Service, said the asbestos-cement pipe industry had long been aware of a link between certain types of asbestos fibers and lung cancer and with Mesothelioma, a rare malignant tumor found on the lung covering and the gastrointestinal tract.

He pointed out, however, that asbestosis (a lung tissue disease) and lung cancer are caused only by inhalation of certain asbestos fibers in large amounts and over long periods of time.

MESOTHELIOMA, he said, has never been linked positively with swallowed amounts of asbestos and is "extremely rare."

"Evidence of research indicates that virtually everyone is exposed to asbestos fibers," he said. "In fact, it would appear reasonable to assume that there is no such thing as not having been exposed. If mere exposure is a cause, we would all have it."

Wright cited widespread use of asbestos fibers in insulation, electrical wiring and stove-ovens and toasters.

"THERE IS a great upswing in the use of asbestos fiber, but the incidence of cancer has actually fallen off," Wright said.

Wright said asbestos-cement pipe, consisting of 20% asbestos fiber, has been in water systems in some areas for as long as 30 years. In many instances, he said, there is no evidence of wear in these pipes to release asbestos fiber.

"After this many years of experience, if these fibers were to be a source of Mesothelioma — a dramatic tumor — it would be known," Wright stated.

"THIS WOULD not escape. This is not a new point of interest to the industry," he added.

Wright said manufacturers of asbestos products were among the first to discover its possible biological effects and have spent "millions of dollars" in the field.

The doctor said he is preparing a written answer to Snell's statement.

"I don't know Snell or his background in this area," Wright said, "but no doctor is knowledgeable in all areas. I have spent much of my life in this field, and even I am not."

SNELL WROTE Lawrence Nov. 14, stating he would consider the use of asbestos-cement pipe "a medical hazard of significant degree" until the U.S. Public Health Service had checked it out completely.

Officials of the Johns-Manville Co., asked about this yesterday, said the Public Health Service is among its customers.

"We have sold them thousands of feet of pipe," said Jay Baker, product manager. "I feel certain we will sell them much more."

THE COUNCILMEN are scheduled to tour the manufacturing plant and research center today. The company claims its product will save Metro $200,000 a year on pipe purchases.

CAPCO KIN 0000181

Asbestos Pipe Use Backed

By JIM SQUIRES
Staff Correspondent

NEW YORK—Eight Metro councilmen recommended yesterday that waterworks director Robert L. Lawrence allow manufacturers of asbestos-cement pipe to bid on Metro pipe purchases.

The councilmen urged that the bans against the firms be dropped after a tour of the Newark, N.J., plant of Johns-Manville Corp., a manufacturer of the asbestos-cement product.

"IT'S A SHAME that a product this good has been kept out of the bidding," said Councilman Frank Griffin. "I see no reason why these manufacturers cannot be given the opportunity to bid for our business."

James LaPenna, chairman of the council purchasing committee, said the tour of the Johns-Manville facility produced "overwhelming evidence that asbestos-cement pipe is a quality product and widely used throughout the world."

Joining Griffin and LaPenna in the recommendation were Councilmen Martin Garrett, John Fox, Mansfield Douglas, John Driver, Earl Stacklett and Robert McBride.

A NINTH councilman making the trip, Tom Sharp, said he would make no recommendation concerning the product pending further investigation. Sharp said he wanted to learn as much about the cast iron water pipe now being used by Metro as he learned about the asbestos-cement product during the two-day visit here.

The councilmen toured the facility at the invitation of Johns-Manville officials at no expense to Metro government. The firm had previously told the purchasing committee it was being excluded from bidding because of Lawrence's opposition to the use of asbestos-cement pipe.

The purchasing committee has been investigating Metro's pipe purchasing practices

(Turn to Page 12, Column 1)

Asbestos Pipe Use Backed

(Continued From Page One)

since a probe by THE NASHVILLE TENNESSEAN disclosed that a single cast iron manufacturer has gotten all Metro water pipe business in the last four years.

THE FIRM, JAMES B. Clow & Son, was successful low bidder on all pipe contracts, while its three major competitors were equally successful in the state's other major cities.

Griffin and LaPenna, after viewing quality and durability tests of the asbestos-cement pipe, said it is "apparent" Metro has been "victimized by a lack of true competition among cast iron pipe companies."

Comparing list prices of asbestos-cement and cast iron pipes, LaPenna estimated Metro can save $25,000 over the next 18 months by allowing asbestos-cement manufacturers to bid against cast iron companies.

"I am not saying we should switch entirely to asbestos-cement or that one product is superior," he said. "It is my personal feeling the two products are comparable and all vendors should be allowed to bid."

LAPENNA SAID councilmen who toured the plant will present their findings to the full purchasing committee later this month. The committee will make recommendations to the council.

Comments from other councilmen concerning asbestos-cement pipe were:

John Fox: "I think these firms have a good product and should be allowed to bid. If installed to specifications, the nature of the terrain will not matter."

Martin Garrett: "Our biggest problem is selling it to Mr. Lawrence. I personally think we should let the contractors buy the pipe and that both cast iron and asbestos-cement companies be allowed to try for the business.

John Driver: "I was amazed at the strength and quality of this asbestos-cement material, especially after what we had heard locally. I think the company should have the privilege of competitive bidding. With expenses continuing to go up, it is advantageous to us to save tax money."

Mansfield Douglas: "I was quite impressed and am convinced that the pipe is sufficient to carry water under the stress and strain anticipated in Metro's system. I see no reason why these companies are not allowed to bid."

Robert McBride: "I feel there are places where asbestos-cement might not work in the local system. At the same time there are places where it will do the job as good as cast iron and at a much lower cost. With a [illegible] expansion program as large as ours, this is a good place for us to save a substantial amount of money."

CAPCO KIN 0000182

12/11/67

Councilmen To Go On Pipe Plant Tour

By JIM HUGHES

Nine Metro councilmen will leave today for a two-day inspection tour of the Newark, N.J., plant of the Johns-Manville Co., a manufacturer of asbestos-cement water pipe.

The pipe firm has invited the lawmakers in an effort to convince them that the cheaper asbestos-cement product is an adequate substitute for the costly cast iron now being used in Metro's water system.

THE COMPANY claims Metro can save $200,000 annually by buying asbestos-cement pipe.

Robert L. Lawrence, Metro waterworks director, has consistently refused to allow asbestos-cement pipe companies to bid on government purchases. He declined the invitation to tour the plant.

Making the trip are Councilmen James LaPenna, Frank Griffin, Earl Shacklett, Mansfield Douglas, Martin Garrett, Thomas Sharp, John Fox, Robert McBride and John Driver.

LaPenna is chairman of the council's "watchdog" committee on purchasing which is now investigating Metro's pipe purchases.

THE COMMITTEE was formed and the probe launched following an investigation by THE NASHVILLE TENNESSEAN which disclosed that one cast iron pipe company, James B. Clow & Sons, has won every Metro pipe contract in the last four years.

Through a hodge-podge pattern of bidding, the investigation disclosed, Clow has gotten all Metro pipe business, while its two major competitors have been equally successful in Chattanooga and Memphis and in small towns surrounding Nashville.

Clow has been the low bidder in Nashville on every contract, while at the same time bidding high on similar pipe in other areas of the state. At the same time, companies bidding high in Nashville consistently underbid Clow in towns as close as Murfreesboro and Columbia.

LaPenna has proposed widening specifications to allow competition between cast iron and asbestos-cement manufacturers.

Lawrence has refused to do this, saying he has no intention of accepting an asbestos-cement company bid no matter how low the price.

AT THE LAST council session, he distributed a pamphlet which claimed to show the superior strength of castiron compared with asbestos-cement.

The pamphlet was prepared by the Cast Iron Pipe Research Association.

The councilmen will return to Nashville tomorrow night.

CAPCO KIN 0000183

Early December, 1964

Council Invited To N.Y. Pipe Study

Members of the Metropolitan Council have been invited to go to New York next month to study the possibility of using asbestos cement pipe for Metro's water system, it was announced yesterday.

Councilman James J. LaPenna, chairman of the council's special "watchdog" committee for government purchases, said the invitation had been extended by the Johns-Manville Co. which maintains a research center just outside New York.

LaPenna's committee voted to take the trip to determine if the pipe would be feasible for use here.

"THIS WILL be a work trip and it will not be an entertainment one," LaPenna told the council. He said it had been estimated Metro would save $250,000 a year by using the pipe instead of cast iron pipe.

For the past 4½ years Metro has bought all its cast iron pipe from a single concern—Clow and Sons — which has consistently submitted the low bid.

LaPenna said all members of the council as well as representatives of the mayor's office and the waterworks department were invited to make the trip Dec. 11-12. Johns-Manville, which manufactures the pipe, will fly the councilmen to and from New York in a company-owned airplane.

COUNCILMAN Richard Taylor attacked the invitation on the council floor, saying, "This is ridiculous . . . this is setting a horrible precedent to offer to take the whole council and the press and television to New York."

He said his committee had considered the pipe and had recommended Metro continue to use cast iron pipe. Taylor said it might be proper for LaPenna to make the trip, but not a large group.

"Why do they want to take you all if they don't expect something in return?" he asked.

COUNCILMAN Sanders Anglea said he felt council members should see the product for themselves.

"We're down here criticizing this product when we don't know anything about it. Those who have been criticizing it ought to go up there and see if what they have had to say is correct," he said.

Councilman Frank Griffin said he agreed with Anglea, adding, "I read about department heads being in Hawaii, in Dallas, in Washington, just about everywhere. But when it comes time for a councilman to go anywhere, there is no money available.

Councilman Mansfield Douglas III said he felt as many councilmen as possible should accept the company's offer.

CAPCO KIN 0000184

Lawrence Raps Pipe Proposals

By DICK BATTLE

Robert L. Lawrence Jr., Metro director of water and sewerage services, said today in his opinion "there is no comparison between asbestos-cement pipe and cast iron pipe."

Nationally recognized as one of the country's outstanding water system authorities, Lawrence blasted proposals by Councilman James LaPenna to change pipe specifications to allow asbestos-cement pipe manufacturers to bid against cast iron pipe producers to force lower bids on iron pipe.

LaPenna was quoted as stating following Tuesday night's council session that he was "not suggesting that Metro switch to the asbestos-cement" but should merely rewrite specifications to

(Please Turn to Page 6, Col. 6)

11/8/62

Lawrence

(Continued From First Page)

allow the asbestos-cement people to bid.

Not Comparable

Lawrence said "asbestos-cement pipe is obviously not comparable to cast iron, particularly for use in our rocky soil. Its strength is much less than cast iron and it would be a disservice to the people of this community to substitute this material for cast iron.

"Based on my own experience and knowledge and the experience and research of some outstanding engineering consultants, I will not recommend the use of this (asbestos-cement) pipe in our system. I am not going to recommend what I consider to be an inferior material for use in our system."

The director scored LaPenna's proposal to change specifications to open up bidding to asbestos-cement pipe with no intention of purchasing such pipe if it came in on the low bid. "It's not honest, as far as I'm concerned," Lawrence said.

Dishonest

"I won't recommend changing specifications to allow bids to be submitted for asbestos-cement pipe when I cannot conscientiously recommend purchase of this pipe if it comes in on the low bid. As far as I'm concerned that would be dishonest. It would also be unfair to the asbestos-cement people who might submit bids, to use them simply to force better prices on cast iron pipe when we have no intention of changing the system to asbestos-cement pipe."

LaPenna, chairman of the council's new "watchdog" purchasing committee, offered the scheme for pushing down bids on cast iron pipe. He also gave every councilman and members of the press a letter he had solicited from an asbestos-cement pipe manufacturer which cited possibility of $277,650 "savings" if Metro shifted from cast iron to asbestos-cement pipe next year.

Savings Offset

Lawrence said the asbestos-cement pipe required "great care" in laying. "The additional cost of laying this kind of pipe would, in my opinion, offset any saving that might accrue from the difference in the cost of the pipe."

LaPenna said the pipe manufacturer with whom he was in correspondence had offered an "all expense paid trip" to the firm's New Jersey plant for members of the council purchasing committee, Lawrence and members of his staff, newsmen and any "other interested individuals".

In answer to questions from the floor, LaPenna said the pipe manufacturing firm's offer "means they'll pick up the tab for everything. I didn't ask what 'everything' means, but I suppose it means EVERYTHING."

His statement was greeted with laughter but there were no immediate "takers."

CAPCO KIN 0000185

Pipe Buying Economy Urged

By JIM SQUIRES

Metro Government could save $200,000 over the next 18 months by switching from cast-iron to asbestos-cement pipe in its water system, Metro Council was told last night.

The report came from the council's new "watchdog" committee on purchasing which is now investigating the government's water pipe purchases that total more than a million dollars annually.

The economy-minded council also:

- Delayed action on a request by Mayor Beverly Briley for an additional $47,500 appropriation this fiscal year for the operation of his office until the mayor submits a list of government spending priorities.
- Adopted a Public Safety Committee report which, in effect, issued an "executive order" directing the administration to call in all government-owned automobiles now assigned for 24-hour use, re-

(Turn to Page 10, Column 4)

Probe Called

Metro Council directed its Human Relations committee last night to investigate reports that Metro firemen are being issued firearms.

"I think we ought to find out just who they plan to use them against and for what purpose they are being issued," said Councilman Mansfield Douglas, in requesting the probe.

Douglas did not comment in detail on his accusations, saying only that he has received reports that "the fire department is being armed."

CAPCO KIN 0000186

11/8/67

Pipe-Buying Economy Eyed

(Continued From Page One)

assign them on a limited basis, and submit 30-day reports to the council on their use.

• Passed on second reading an ordinance establishing fees ranging from $100 to $1,000 for licenses to sell liquor by the drink.

• Deferred a hotly contested proposal to appropriate $10,000 for a feasibility study by outside consultants on the extension of Capitol Boulevard—a proposal already disapproved by the Metro Planning Commission.

Metro's pipe purchasing has been the subject of much controversy since an investigation by THE NASHVILLE TENNESSEAN disclosed earlier this year that one pipe company, James B. Clow & Sons, has won every Metro pipe contract in the last four years.

Through a hodge-podge pattern of bidding, Clow has gotten all Metro business, while its two major competitors have been equally successful in Chattanooga and Memphis and in small towns surrounding Nashville.

Councilman James LaPenna, chairman of the purchasing committee, presented a letter to the council last night from the Johns-Manville Co., an asbestos-cement pipe manufacturer, offering its product at a "savings" to the government.

Based on anticipated expenditures for cast-iron pipe in 1968, the letter said, the cost would be $277,050 for cast iron and $182,340 for asbestos-cement—a difference of $94,710.

LAPENNA SAID further projections for an 18-month period call for cast-iron pipe expenditures of $900,000. The same amount of asbestos-cement pipe, he said, would be $300,000 less.

Following the session, La Penna said he was not suggesting that Metro switch to the asbestos-cement but merely rewrite purchase specifications so that asbestos-cement manufacturers would be allowed to bid.

"If these pipe manufacturers are allowed to bid against each other," he said, "cast iron prices will be lower."

ROBERT L. LAWRENCE, Metro waterworks director, has opposed any broadening of specifications because "asbestos might win and I don't want it in my system."

The issue over the mayor's increased budget request was actually settled earlier this week when Kenneth Miller, chairman of the council budget and finance committee, asked the mayor for the spending priorities.

Briley indicated the police department ranked highest on his list but that his office could not operate effectively without the supplemental appropriation.

The council cut the mayor's $210,000 budget request by $69,000 earlier this year, granting the mayor some $40,000 less than he had last year.

THE PROPOSAL WAS deferred by voice vote last night without controversy.

Although councilmen haggled over minor issues, the only major dispute came as Councilman Robert Lillard made a strong pitch for a $10,000 appropriation for an outside study on the proposed Capitol Boulevard Extension.

Lillard termed the extension "a vital project" to the life of the downtown area and implied that the Metro Planning Commission did not keep this in mind in recommending against the project.

He urged that city planners give more weight to the recommendations of numerous downtown businessmen who favor the extension.

COUNCILMEN James L. Warren and Richard Adams joined budget and finance committee spokesmen to defeat Lillard's motion and defer action until the planning commission can defend its position before the entire council.

In a surprising and somewhat complicated move, the council also deferred action on a bill that would prevent the unnecessary use of government-owned vehicles.

Instead, it accepted a committee report which provided that the bill be "held in abeyance" for 90 days. The report also recommended that the bill be amended to provide that any employe found guilty of misuse be suspended for five days and that any department head who knowingly allows misuse be suspended for three days.

MANY COUNCIL observers indicated they believe the bill to be "punitive legislation" outside the legislative powers of the council.

Although the bill was not actually passed, the committee report directs Col. John Sullivan, head of the department of general services, to recall all automobiles except those of the mayor, police chief and fire chief.

The report says the automobiles are to be reassigned to employes designated by department heads, but that Sullivan is to submit a written report every 30 days concerning their use.

In other action, the council:

• Directed the planning commission to prepare the necessary documents to implement the expansion of Urban Services to the General Services District during the next four years.

• Heard Councilman Robert McBride warn that Central High School is in such deplorable condition that it could easily be destroyed by fire as Dupont High was Monday night.

• Passed a resolution offering its cooperation to the Metro Board of Education to assure that Dupont students resume classes with a minimum of delay.

• Authorized the issuance of $27,500 in promissory notes for the purchase of property on Fifth Avenue, North, across from the courthouse as a site for a new Metro Office Building.

11/9/67

TO: Mr. W. R. Bond
Mr. S. D. Weaver

FROM: Mr. I. L. Taylor

CAPCO KIN 0000187

THE NASHVILLE TENNESSEAN

SILLIMAN EVANS SR. *(Publisher, 1937-1955)* SILLIMAN EVANS JR. *(Publisher, 1955-1981)*

AMON C. EVANS, Executive Vice President and Publisher

JOHN SEIGENTHALER, Editor LLOYD ARMOUR, Associate Editor

The news columns shall be fair and accurate and the editorial columns shall be honest and just in the expression of conscientious opinion.—Silliman Evans Sr.

People Can Find Fault

MR. ROBERT L. LAWRENCE Jr., Metro waterworks director, says he can "find no fault" with purchasing practices which have permitted one company to supply practically all of Metro's iron water pipe for the past five years.

Perhaps Mr. Lawrence has not looked for enough for the fault. But the people find it strange, to say the least, that James B. Clow & Sons Co. consistently turn in low bids on iron pipe in Nashville, while the firm is almost always underbid on the same pipe in Chattanooga and Memphis.

The business of Chattanooga and Memphis usually goes to U.S. Pipe and Foundry Co., while Clow consistently is successful bidder for pipe sales to Metro and Knoxville.

"If there's any collusion," Mr. Lawrence told Metro Council's purchasing committee, "then it's something for the federal government to look into. They have a responsibility in this area."

Mr. Lawrence is right about that. The Justice Department should look into the matter, and Councilman Frank Griffin suggested that the committee should go to the district attorney.

But this does not relieve the waterworks department of the responsibility to see that the taxpayers are not being cheated on the purchase of iron pipe. Mr. Lawrence is not doing enough just to sit back and open the bids without trying to find out why Clow is always low bidder in Nashville and U.S. Pipe and Foundry is low in Memphis and Chattanooga. In addition, Council has a responsibility to make sure that competitive bidding is a part of the government's purchasing and contract procedures and policies.

Mr. Lawrence showed the committee a tabulation of comparative costs of water pipe in Metro and six other cities. The tabulation showed that Metro was paying more for the pipe in 19 out of 20 instances, but Mr. Lawrence said this was because his department purchases "superior pipe."

The question is whether some other "superior pipe" isn't cheaper.

Other cities seem to get by all right on what Mr. Lawrence probably would call "inferior" materials. They get their pipe at a lower price than that paid by Metro.

The purchasing committee should demand that the waterworks department not rely entirely on the district attorney and use initiative of its own to find out why one firm is selling all of its

CAPCO KIN 0000188

PNEUMOCONIOSIS RESEARCH UNIT

Visit by Medical and Science Correspondents
Wednesday, 22nd February, 1967

ASBESTOS AND CANCER

It is now accepted that there is an association between exposure to asbestos dust and the development of certain cancers. These are cancers of the lung and mesotheliomas of the pleura and peritoneum. There is evidence that there is an increased incidence of cancers of the gastro-intestinal tract; this has been produced by German and American investigators. The cancers of the lung occur in workers with severe asbestosis - fibrosis of the lung due to asbestos dust. In contrast to this the mesotheliomas can occur in people with minimal fibrosis and, in some cases, asbestos is found in the lungs but insufficient to cause any scarring of the lung tissue. In these people the exposure to asbestos dust is relatively slight, and may be as little as three months. In some cases, the exposure has been environmental, not occupational. The time between the exposure and the development of the tumour is usually more than thirty years. These diseases are due to the inhalation of asbestos dust. There is no known danger through drinking water from asbestos pipes, or beer that has passed through asbestos filters.

Asbestos is a generic term applied to a number of fibrous silicates. Four types of this material are, and have been, used commercially in Britain. These are chrysotile, crocidolite, amosite and anthophyllite. Chrysotile is by far the commonest type, the total world annual production being more than 3,000,000 tons; the main sources are the Soviet Union, Canada, South Africa, and Cyprus. Crocidolite (blue asbestos) is mined in South Africa and until recently in Western Australia - the annual production is about 150,000 tons; the amount imported into Britain has been reduced in recent years, and is now 7,500 tons. Amosite is found only in South Africa where 100,000 tons are produced annually, the use of this fibre is increasing in Britain and about 30,000 tons was brought in last year. Anthophyllite is mainly produced from a small mine in Finland, with an annual production of 15,000 tons; only a small amount of this is used in Britain. About 500 cases of cancer of the lung and mesothelioma are known to have occurred among people exposed to asbestos dust in the United Kingdom. This is hardly significant when one realises that more than 25,000 cases of carcinoma of the lung are diagnosed each year.

On current evidence from South Africa, Australia and Britain, it would appear that crocidolite is mainly implicated in the development of the mesotheliomas. However, cases have occurred in the United States, Canada and a few in Britain in which the people concerned appear to have only been exposed to chrysotile. The major problem at the moment is to establish whether only one type of asbestos is responsible for the development of these tumours, and if other varieties can be exonerated. Exposure to only one type of asbestos is unusual in a manufacturing country such as Britain, therefore to find populations exposed to a single type of asbestos, surveys have to be undertaken in the mining areas. It is also hoped that information obtained from animal experiments may be valuable in the assessment of this hazard.

Members of the staff of this Unit have played a prominent part in the discovery and investigation of the association between mesotheliomas and exposure to asbestos dust. They were concerned in the original definition of the condition in South Africa, its recognition in Britain, and the development of the international [illegible] in operation.

JCW/Y
16.2.67

Pneumoconiosis Research Unit,
Llandough Hospital,
Penarth, Glamorgan.

CAPCO KIN 0000189

Chemical Carcinogenesis and Cancers

By

W. C. HUEPER, M.D.

Chief
Environmental Cancer Section
National Cancer Institute
Bethesda, Maryland

and

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Former Senior Chemist
Environmental Cancer Section
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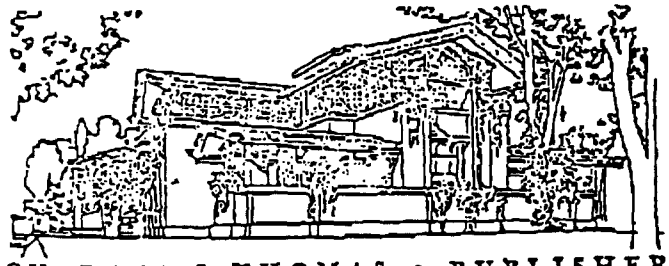

CHARLES C THOMAS • PUBLISHER
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1964

CAPCO KIN 0000190

TABLE 1

Recognized Environmental and Occupational Carcinogens, Their Routes of Exposure and Their Target Organs

General Type	*Specific Type*	*Route of Exposure*	*Target Organ*
Chemical Carcinogens			
Organic Chemicals			
Aromatic, Polycyclic, Heterocyclic	**Benzol**	**Cutaneous**	**Blood Forming Organs**
		Respiratory	**(Leukemia, Lymphosarcoma)**
	Beta-Naphthylamine	**Respiratory**	**Urogenous Organs**
	Benzidine	**Cutaneous**	**(Bladder, Ureter, Kidney)**
	4-Aminodiphenyl	**Alimentary**	**Lung? Intestine?**
	Auramine		
	Coal Tar, Pitch	**Cutaneous**	**Skin**
	Asphalt, Tar Oil, Creosote Oil, Anthracene Oil, Lamp Black, Lignite Tar and Paraffin Oil	**Respiratory**	**Lung**
	Synthetic Hydrogenated Coal Oil and Tar (Bergius)	**Cutaneous**	**Skin, Oral Cavity?**
	Shale Oil and Paraffin Oil	**Cutaneous**	**Skin**
		Respiratory	**Larynx**
	Petroleum Fuel Oil, Diesel Oil, Lubricating Oil and Grease, Cutting Oil, Carbon Black, Asphalt, Tar, Coke	**Cutaneous**	**Skin**
		Respiratory	**Lung**
	Crude Paraffin Oil		
Aliphatic	**Isopropyl Oil**	**Respiratory**	**Nasal Sinus**
			Larynx
			Lung
	Mustard Gas	**Respiratory**	**Lung, Larynx**

TABLE 1 (*Continued*)

General Type	*Specific Type*	*Route of Exposure*	*Target Organ*
Chemical Carcinogens			
Inorganic Chemicals	**Arsenic**	**Cutaneous**	**Skin**
		Ingestive	**Liver, Alimentary Tract**
		Respiratory	

CAPCO KIN 0000191

Mustard Gas — Respiratory — Lung, Lung, Larynx

TABLE 1 (*Continued*)

General Type	*Specific Type*	*Route of Exposure*	*Target Organ*
Chemical Carcinogens		Cutaneous	Skin
Inorganic Chemicals	Arsenic	Ingestive	Liver, Alimentary Tract
		Respiratory	Lung, Nasal Sinus, Larynx
	Nickel	Respiratory	Nasal Cavity
			Nasal Sinus
			Lung
	Chromates	Respiratory	Lung, Nasal Sinus
	Asbestos	Respiratory	Lung, Pleura, Peritoneum
Physical Carcinogens (ionizing Radiation	Ultraviolet Radiation	Cutaneous	Skin
	X-radiation	Cutaneous	Skin
		Transcutaneous	Connective Tissue
			Bone
			Blood Forming Organs
	Radioactive Radiation (Alpha-Beta- and Gamma Radiation)	Cutaneous	Skin
		Transcutaneous	Connective Tissue
			Blood Forming Organs
		Respiratory	Nasal Sinus
			Lung
		Ingestive	Bone
		Parenteral	Liver
		Cutaneous	Bladder
Parasitic Carcinogens	Schistosoma Hematobium		
	Clonorchis sinensis	Ingestive	Liver

CAPCO KIN 0000192

TABLE 2

Suspected and Potential Chemical Human Carcinogens of Economic Significance

Agent	Site of Tumor	Type of Exposure	Species	Types of Human Contact	Investigator
Beryllium	Bone	Intravenous Respiratory	Rabbit	Phosphor, Alloy,	Gardner; Dutra; Vorwald; Schepers
Mercury		Intraperitoneal	Rat	Felt production, Instruments	Druckrey, Schmähl & Mecke
Cobalt	Subcutis	Parenteral	Rat	Metal, Pigment, Alloy, Vitamin B12	Heath
Iron Oxide	Lung	Respiratory	Man	Dust in Mining and Foundry, Polishing	Faulds *et al.*; Dreyfuss; McLaughlin & Harding
Iron-Polymaltose Complex	Subcutis	Subcutaneous	Rat Mouse	Drug	Zollinger Richmond
Iron-Polydextrin Complex Iron-Dextran Complex				Drug Drug	Haddow and Horning
Selenium	Liver Thyroid	Ingestive	Rat	Drug, Nutrient, etc.	Nelson *et al.*; Fitzhugh *et al.*; Schiffer *et al.*
Lead Acetate	Kidney	Subcutaneous Ingestive	Rat		Zollinger; van Esch *et al.*
Aminotriazole	Thyroid	Ingestive	Rat	Herbicide	Flemming; Jukes, and Shaffer
Nitrosamines	Liver Lung Bladder Esophagus etc.	Ingestive	Rat Hamster	Textile Chemical	Druckrey *et al.*; Thomas, Argus and Hoch-Ligeti; Dontenwill and Mohr; Schoental and Magee
Beta-Propiolactone	Skin Subcutis	Cutaneous	Mouse	Virucide	Roe and Salaman; Searle
Diethylene Glycol	Bladder	Ingestive	Rat	Humectant	Nelson, Fitzhugh and Schoental
Polyoxyethylene (8) stearate	Bladder	Ingestive	Rat	Emulsifier	Fitzhugh *et al.*; Hueper and Payne
Thiourea, Thiouracil	Thyroid	Ingestive	Rat	Fungicide	Purves and Griesbach; Gorbman;
Isonitotinic acid hydrazide	Lung	Ingestive	Mouse	Drug	Paschkis *et al.*
Thioacetamide					Schwan; Viallier *et al.*; Fitzhugh and
Acetamide	Subcutis Liver	Subcutaneous Ingestive	Mouse Rat	Drug Fungicide	Nelson; Dessau and Jackson; Dupta; Dielschowsky

TABLE 2 (*Continued*)

Agent	Site of Tumor	Type of Exposure	Species	Types of Human Contact	Investigator
Tannic Acid	Liver	Subcutaneous	Rat	Drug	Kuppasy *et al.*; Kirby
Carbamates	Lung	Ingestive	Mouse	Drug	

CAPCO KIN 0000193

CAPCO KIN 0000194

TABLE 2 (*Continued*)

Agent	*Site of Tumor*	*Type of Exposure*	*Species*	*Types of Human Contact*	*Investigator*
Tannic Acid	Liver	Subcutaneous	Rat	Drug	Xorpasy *et al.*; Kirby
Carbamates	Lung	Ingestive	Mouse	Drug,	Nettleship and Henshaw; Mottoli and
	Skin	Subcutaneous	Rat	Herbicide	Larsen; Larsen; Roe and Salaman; van Esch *et al.*; Dale
Safrole	Liver	Ingestive	Rat	Flavoring Agent	Homburger *et al.*
p-Phenetylurea (Dulcin)	Bladder Tumor	Ingestive	Rat	Sweetener	Fitzhugh and Nelson; Griepentrog
β-anthraquinoline	Kidney	Subcutaneous	Rat	Industrial Arsenical	Semproni; Morelli
8-Hydroxyquinoline	Bladder	Intravesical,	Mouse	Preservative	Boyland and Watson; Hoch-Ligeti
	Brain	Intravaginal Ingestive	Rat	Contraceptive	
p-Quinone	Subcutis	Cutaneous	Mouse	Industrial Chemical	Umeda; Takizawa
	Skin	Subcutaneous	Rat		
4-Nitroquinoline N-oxide	Skin	Cutaneous	Mouse	Fungicide	Takayama; Nakahara and Fukuoka
Styryl 150	Subcutis	Subcutaneous	Mouse	Trypanocidal Drug	Browning *et al.*
Dodecane	Skin	Cutaneous	Mouse	Detergent, Paraffin Oil	Shubik *et al.*; Eckardt
Tween 60 (Polyoxethylene sorbitan monostearate)	Skin	Cutaneous	Mouse	Emulsifier	Lusky and Nelson; Setälä *et al.*
Methylated Naphthalenes	Skin	Cutaneous	Mouse	Solvent	Pool *et al.*; Andervont
Chlorofom	Liver	Ingestive	Mouse	Drug, Solvent	Eschenbrenner and Miller
Carbon Tetrachloride	Liver	Ingestive		Solvent	Edwards *et al.*
DDT (Chlorophenothane)	Liver	Ingestive	Rat Dog	Insecticide	Fitzhugh and Nelson; An der Lan
Aramite	Liver	Ingestive	Rat Dog	Pesticide	Sternberg *et al.*
Epoxides Aliphatic and Aromatic	Skin	Cutaneous	Mouse	Drug; Evaporants of Gasoline	Hendry *et al.*; Kotin *et al.*; Walpole *et al.*
Oxidized and Polymerized Fatty Acids	Subcutis	Subcutaneous	Rat	Emulsifier; By-product of Deep Fat Frying	Druckrey *et al.*

TABLE 2 (*Continued*)

Agent	Site of Tumor	Type of Exposure	Species	Types of Human Contact	Investigator
Fischer-Tropsch	Skin	Cutaneous	Mouse	Petroleum Substitutes	Hueper
Hydrogenated Coal Oils	Subcutis	Subcutaneous	Rat		
Estrogens	Uterus	Ingestive	Mouse	Drug, Feed Additive	Lacassagne; Burrows and Horning; Herrs; Horning
Natural and Synthetic	Breast	Subcutaneous	Rat		
	Bone Marrow				
	Testis				
	Lymphoid Tissues				
Dichlorobenzidine	Subcutis	Subcutaneous	Rat	Industrial Chemical	Pliss *et al.*
	Breast		Mouse		Terakin
	Intestine				
	Bladder				
	Sebaceous Glands		Mouse		
	Liver				
Agent	Site of Tumor	Type of Exposure	Species	Types of Human Contact	Investigator
o-Tolidine	Ear Duct	Subcutaneous	Rat	Folliculization Test Reagent	Spitz *et al.*
Pyridium	Bladder	Intravesical	Mouse	Bladder Sedative	Allen *et al.*
Chloronitrosaniline	Bladder	Cutaneous Respiratory	Man	Drug Intermediate	Hueper
Amino- and Nitrostilbenes	Ear Duct	Ingestive	Rat	Industrial Chemical Whitener	Schmähl; Druckrey *et al.*
	Subcutis	Subcutaneous			
Alpha Naphthylamine	Bladder	Cutaneous Ingestive	Man	Dye- and Antioxidant Intermediate	Williams; Case
4-Nitrophenyl	Bladder	Ingestive	Dog	Industrial Chemical	Deichmann *et al.*; Williams
Magenta	Bladder	Ingestive Cutaneous	Man	Aniline Dye	Williams; Case; Walpole
Senecio Alkaloids	Liver	Ingestive	Rat	Drug	Schoental; Cook *et al.*
Capsicum	Liver	Ingestive	Rat	Flavoring Agent, Drug	Hoch-Ligeti

CAPCO KIN 0000195

TABLE 3

Suspected and Potential Carcinogenic Food-, Drug-, Cosmetic-, and Industrial Dyes

Dye	Evidence	Target Organ	Animal	Route	Investigator
Beta-Naphthylamine Compounds					
Yellow AB (U.S.)? (2-amino-1-naphthol release)	Occupat.	Bladder	Dog	Oral	Hueper et al.
Yellow OB (U.S.)?	Occupat.	Bladder	Dog	Oral	Conway and Lethco
		POTENTIAL HUMAN CARCINOGENS			
2 Hydroxynaphthalene Compounds					
Sudan I (O.C.)	Experiment	Liver	Mouse	Subcutaneous	Kirby and Peacock
Orange SS (O.C.)		Connect. Tissue	Mouse	Subcutaneous	Bonser
		Intestine			
Oil Yellow IIA (O.C.)		Liver	Mouse	Oral	Kirby and Peacock
Sudan IV (O.C.)		Liver	Rat	Oral	Willheim and Ivy; Hackmann
			Mouse		
Sudan Brown RR (not used)		Liver	Rat	Oral	Hackmann
		Stomach			
		Hematopoietic Tissue			
2-Aminonaphthalene Compounds					
Thiazin Brown R		Subcut. Tissue	Rat	Subcutaneous	Hecht
Evans Blue (not used)		Liver	Rat	Intraperit.	Marshall
Trypan Blue (not used)		Liver	Rat	Subcutaneous	Gillman
		Subcut. Tissue			Marshall
		Lymphoid Tissue			Simpson
					Brown and Thorson
Black 5410 (O.C.)		Subcut. Tissue	Rat	Subcutaneous	Hecht
Azo-benzol Compounds					
Butter Yellow (O.C.)		Liver	Rat	Oral	Kinoilta
		Bladder	Dog	Oral	Nelson & Woodard

o.c. = used or formerly used in countries other than U.S.A.

TABLE 3 (*Continued*)

CAPCO KIN 0000197

	Lymph Tissue			Simpson
				Brown and Thomson
Black 5410 (O.C.)	Subcu[illegible]issue	Rat	Subcutaneous	Hecht
Azo-Benzol Compounds				
Butter Yellow (O.C.)	Liver	Rat	Oral	Kinosita
	Bladder	Dog	Oral	Nelson & Woodard

a.c.=used or formerly used in countries other than U.S.A.

TABLE 3 (*Continued*)

Dye	*Evidence*	*Target Organ*	*Animal*	*Route*	*Investigator*
Triphenylmethane Compounds					
Light Green SF (U.S.)	Experiment	Subcutaneous Connect. Tissue	Rat	Subcutaneous Tissue	Schiller Goss Harris Nelson and Hagan Hecht
Brilliant Blue FCF (U.S.)		Subcutaneous Connect. Tissue	Rat	Subcutaneous Tissue	Nelson and Hagan Goss
Fast Green FCF (U.S.)		Subcutaneous Connect. Tissue	Rat	Subcutaneous Tissue	Nelson and Hagan
Azurblue VX (O.C.)		Hematopoietic Tissue	Mouse	Oral Cutaneous	Miller and Pybus
Guinea Green B (U.S.)		Subcutaneous Connect. Tissue	Rat	Subcutaneous Oral	Nelson and Hagan Willheim and Ivy
Parafuchsin		Subcutaneous Connect. Tissue	Rat	Subcutaneous	Druckrey, Nieper and Lo
Rhodamine B (O.C.)		Subcutaneous Connect. Tissue	Rat	Subcutaneous	Umeda
Rhodamine 6G (O.C.)		Subcutaneous Connect. Tissue	Rat	Subcutaneous	Umeda
Fluorescein Sodium (not used)		Subcutaneous Connect. Tissue	Rat	Subcutaneous	Umeda
Eosin (water sol.) (O.C.)		Subcutaneous Connect. Tissue	Rat	Subcutaneous	Umeda

CAPCO KIN 0000198

TABLE 4

CARCINOGENIC MACROMOLECULAR NATURAL, SEMISYNTHETIC AND SYNTHETIC CARBON AND SILICON POLYMERS AND PLASTICS

Name	*Description*	*Investigator*
	I. Water-Insoluble Polymers	
	(a) Hydrocarbon Polymers Synthetic	
Polythene	Polyethylene	Oppenheimer *et al.*; Druckrey *et al.*;
Lucite	Polymethylmethacrylate	Bering and Handler Oppenheimer *et al.*;
Polystyrol	Polyvinylbenzol	Laskin *et al.*; Zollinger
Ivalon	Cross linked polyvinyl alcohol	Oppenheimer *et al.*
Dacron	Polyester condensate of terephthalate and ethylene glycol	Oppenheimer *et al.*
Bakelite	Phenol-formaldehyde condensate	Oppenheimer *et al.*
	(b) Halogenated Hydrocarbon Polymers (Synthetic)	Turner
Saran PVC, Igelit, Vestolit, Vinnol	Polyvinylene chloride	Oppenheimer *et al.*
Teflon	Polyvinyl chloride	Oppenheimer *et al.*
Pliofilm	Polyfluor (chlor) -olefine	Oppenheimer *et al.*
Vinyon N, Dynel	Polymethylmethacrylate chloride	Oppenheimer *et al.*
	Copolymer of vinyl chloride and acrylonitrile	Oppenheimer *et al.*
	(c) Aminized Hydrocarbon Polymers (polyamides)	
Nylon	Polyhexamethylene diamine adipanide	Oppenheimer *et al.*
Perlon	Poly-ε-caprolactam, polyurethane	Druckrey *et al.*; Hueper
	(d) Hydrocarbon Polymers (Semisynthetic and Natural)	
Rubber	Processed latex gum	Druckrey *et al.*
Cellophane	Processed polyglucose (Cellulose)	Oppenheimer *et al.*; Druckrey *et al.*
Linen		Körbler and Frank
Parchment paper	Processed cellulose	Oppenheimer *et al.*
Silk		Oppenheimer *et al.*
Keratin		Oppenheimer *et al.*
Ivory		Nothdurft
	(e) Silicon Polymers	
Silastic	Polydimethylsiloxane Processed (silicon rubber)	Oppenheimer *et al.*; Mohr and Nothdurft Hueper
	II. Water-Soluble Polymers	
PVP	Polyvinylpyrrolidone	Hueper; Lusky and Nelson
Dextran	Polyglucose	Hueper
CMC, Collocel	Carboxymethylcellulose	Lusky and Nelson

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CAPCO KIN 0000199

A contamination of surface water and ground water with petroleum products may also be connected with the recently introduced use of petroleum asphalts as mulching agents in tobacco fields and on acreage carrying similar crops.

Any exposure to carcinogenic petroleum chemicals contained in the drinking water which the general public might sustain would be in addition to alimentary contacts to similar chemicals contained in and contaminating foodstuffs, when insufficiently refined petroleum waxes and mineral oils are employed in the manufacture of wrapping and packaging materials, in the processing of foodstuffs and for medicinal purposes (Hueper; Falk, Kotin and Miller; Schmähl and Reiter; Shubik *et al.*).

Coal Tar and Tar Oils. A pollution of public waters with similar carcinogenic chemicals results through the release of effluents from gas plants, coke oven operations, tar distilleries, tar paper plants, wood pickling plants, tarred roads, etc., since coal tar, pitch, creosote, and anthracene oil are known human carcinogens. It is, however, undetermined whether or not an ingestion of such products of the distillation of coal will cause cancers of the alimentary tract in man, although such an action has been suspected. No epidemiologic information is available whether populations obtaining their drinking water from bodies of water into which such effluents were released have any excessive liability to cancers. Since in at least one large Midwestern metropolitan area unfiltered lake water containing effluents from nearby located steel plants and oil refineries and often distinctly flavored by such products is supplied for public consumption, such pollutants may not be without carcinogenic significance to the local cancer panorama and, therefore, are of distinct public health interest.

The immediate need for such studies is suggested by recent observations of Diels and Tromp from Holland, who found that cancer death rates in municipalities with a water system since 1951 tended to be lower than in those without a water system, and that municipalities receiving their drinking water from polluted rivers had a higher cancer death rate (606 per 100,000) than those which obtained their drinking water from bodies of water in heaths (595), dunes (585), or wells (568).

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The recent investigations of the National Water Quality Network in this country revealed marked differences in the content of aromatic chemicals in the water of American rivers and lakes. While the average content on aromatic chemicals ranged from 1 to 4 parts per million, it stood at 11 to 37 parts in the Mississippi river at Cape Girardeau, but was 1 part at Vicksburg. The aromatic chemical content of the Ohio river was from 4 to 48 parts at Cincinnati, and 3 to 11 parts at East Liverpool, while the Hudson river at Poughkeepsie contained 3 to 80 parts of aromatic chemicals per million. Such variations in the aromatic chemical content of the water of the various rivers at different sites and at different times reflect, in part, the types and quantities of industrial and domestic effluents released into these bodies of water in different areas; in part, they are the result of fluctuations in the amount of water and the speed of flow present in these rivers at different periods.

If, therefore, cancer hazards should be related to the consumption of drinking water obtained from bodies of water thus polluted, one should anticipate that the carcinogenic effects produced in the exposed populations should not only differ in degree, i.e., the number of individuals affected but probably also in type, i.e., in the organs involved in different localities and should depend on the particular source of drinking water used.

Wedgwood and Cooper studied sludge from sewage for polynuclear aromatic hydrocarbons in England and demonstrated among various chemicals of this type also two carcinogens, namely 3,4-benzpyrene and 1,2-benzanthracene. They suspected that these chemicals might have been introduced into the sewage with effluents discharged from gas works, washings from macadam roads and atmospheric soot washed from the air by rain.

Borneff and his coworkers in a series of investigations likewise demonstrated the presence of several carcinogenic polycyclic aromatic hydrocarbons in the sludge of public waters in Germany and stated that the main source of these chemicals are carcinogenic constituents contained in ship fuel oils, runoffs from asphalted and oiled streets, and effluents of oil refineries, and only to a lesser extent carcinogens present in liquid and particulate wastes from coke oven and steel plants, carbon black factories, and runoffs from tarred roads.

CAPCO KIN 0000201

Experiments with adsorbates on activated carbon obtained from the water of a river near the entrance of effluents from a large coke oven plant gave negative results when the eluants were painted on the skin of mice (Hueper and Payne). In subsequent experiments in which chloroform eluates from adsorbates of raw and finished water of a river polluted heavily with industrial chemical pollutants were used, these elicited when subcutaneously injected into mice, the development of cancers at the site of injection. Chloroform eluates as well as alcohol eluates of such adsorbates on activated carbon prepared from raw and finished water when subcutaneously injected or cutaneously applied, were probably the cause of leukemic reactions in some mice. The presence of a bladder papilloma in one mouse injected with a chloroform eluate of raw water pointed to the probable contamination of the water with chemical carcinogens acting on the bladder and released from rubber manufacturing plants. Hueper and Payne concluded from these observations that the rapidly growing contamination of sources of drinking water supplies with carcinogenic agents demonstrated the urgent need for comprehensive chemical, experimental and epidemiologic investigations on water pollutants for ascertaining whether or not such exposures of the general population may represent significant environmental cancer hazards.

Borneff also conceded the possibility of cancer hazards to the general population from such water pollutants. Druckrey and Schmähl recently called attention to the fact that drinking water might be contaminated with carcinogenic aromatic hydrocarbons since the pitch used for the coating of water pipes is carcinogenic to animals. It is not likely, however, that the degree of any potential cancer hazard which might be related to this source can be compared with that which might result from the continuous contamination of drinking water by similar chemical carcinogens from industrial wastes.

Chromium: The carcinogenic properties of certain chromium compound encountered occupationally, mainly in chromate producing plants and pigment operations, are well established by the demonstration of a high incidence rate of lung cancers among the workers employed in such establishments and by the

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MAV ——— ☐
REK ——— ☐
ENH ——— ☐
MRC ——— ☑

January 22, 1968

Mr. S. D. Weaver
Vice President and General Manager
Cement Asbestos Products Company
2144 Highland Avenue, South
Birmingham, Alabama 35205

Dear Davis:

Mr. Ball sent me the attached JM Bulletin on "Asbestos and Human Health" with covering letter by Mr. Burnett to JM officials.

Yours sincerely,

Charles F. Barber

Attach.

bcc: MJMessel - A/M - w/enc.
KWNelson - A/M - w/enc.

CAPCO KIN 0000203

To Be Made Effective:
Immediately

President's Bulletin

No. 202

January 18, 1968

Statement on
Asbestos and Human Health

In recent months we have seen an increasing number of scientific papers, magazine articles and news media comments on the subject of asbestos and its relationship to human health. This is of major concern to all of us.

Your copy of our basic statement on this subject, "Asbestos and Human Health" is attached.

It is a concise, precise-worded statement summarizing all the facts we know today concerning the relationship between asbestos and health. It was prepared by our Environmental Control, Industrial Relations and Public Relations Departments, reviewed and approved by Dr. George W. Wright, who is our Medical Consultant, and all other members of our Environmental Health Committee.

It will be used as needed by myself, by the Vice President for Finance, Vice President and General Counsel, Controller, Environmental Control and Public Relations Departments in handling inquiries from stockholders, financial analysts, public officials, the press and other outside groups.

You will find it helpful in answering questions on this subject that may be directed to you by other J-M employees, by customers and public officials. With this in mind, I suggest you familiarize yourself thoroughly with its contents.

If you encounter questions that cannot be answered adequately by the statement, please relay them to F.J.Solon, Jr., Chairman of our Environmental Health Committee. He will see that you get a prompt reply.

C.B.Burnett

TO: 101, 105
51, 52, 53
551

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.

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In the United States, chrysotile, amosite and crocidolite are all used, but chrysotile is by far the most common, accounting for about 90 per cent of the asbestos consumed in this country.

NO RISK SHOWN FOR GENERAL PUBLIC

In studies of asbestos exposure and human health, research has not shown evidence of any risk to the general public from the use of finished asbestos products. There is no scientific 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.

The lungs of workers known to have repeated exposure to the inhalation of asbestos fiber over a period of months or years contain myriads of small microscopic sized structures composed of a fiber coated with layers of protein and iron pigment. The fiber within the coating, under the circumstances, is assumed to be asbestos and the small unit therefore is called an "asbestos body." These bodies are found in the lungs of those who are occupationally exposed to asbestos fibers, regardless of whether or not there is any coexisting evidence of asbestosis. Therefore, the bodies, as such, are not an indication of disease but rather only of previous exposure to asbestos fibers.

Recently, by utilizing special techniques, it has been shown that the lungs of persons from the general population rather frequently contain a very scant number of similar small bodies composed of a fiber coated with protein and iron pigment. In these instances, it cannot be assumed that the fiber of these bodies is "asbestos," since other fibrous materials are known to develop a similar appearance within the lungs. For the present, the term "ferruginous" or iron-coated body is more appropriate.

The finding of ferruginous bodies in such small numbers in no way indicates that disease caused by asbestos fiber coexists and the presence of such bodies does not, in any way, justify a diagnois of asbestos-caused disease. If it is ultimately shown that these small bodies are in fact protein covered asbestos fibers their wide dispersion in the population would not be too surprising in view of the many opportunities, from baby powder to building construction, for a small number of asbestos fibers to exist from time to time in the air that the general public breathes. The presence of these few fibers bodies in the lungs of the majority of the population is not associated with specific lung disease but simply reflects the chance inhalation of fibrous material. The complete implications of large numbers of ferruginous bodies within the lungs await further research.

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

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reported from South African areas where only crocidolite asbestos is produced.

Mesothelioma has been reported so infrequently that there are no accurate figures on its occurrence in the U. S. as a whole. In Britain, only two cases are currently being reported for every thousand cases of lung cancer. The search for the cause of such a rare disease is difficult, particularly since medical people themselves do not agree on its diagnosis and recognition. The asbestos industry, through research grants, is seeking more knowledge about mesothelioma.

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-collecting devices. Atmospheric dust levels are regularly monitored. Filters and ventilators have been installed. Individual respirators are used where indicated. Employees are given physical examinations, including chest x-rays, on a scheduled basis.

A program of consultation with asbestos fabricators and applicators is carried on to provide 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 U.S. indicate that where dust control measures have been taken, the risks of lung diseases have been reduced.

ASBESTOS AND HEALTH RESEARCH

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 study of asbestos processing plants. In addition, the company provides funds, asbestos materials, equipment and information, as the individual situation may require.

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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.

# # # #

January 15, 1968

CAPCO KIN 0000209

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February 8, 1968

Mr. S. D. Weaver
Vice President and General Manager
Cement Asbestos Products Company
2144 Highland Avenue, South
Birmingham, Alabama 35205

Dear Davis:

The attached progress report on the environmental health problem in the asbestos cement pipe area was received this morning from Mr. Ball. I am sending a copy along on the assumption that you did not receive a copy directly.

Yours sincerely,

Charles F. Barber

Attach.

bcc: MJMessel - A/M - w/attach.
KWNelson - A/M - w/attach.

Memo from Herbert Morton Ball

The attached is a progress report on our common environmental health problem in the asbestos-cement pipe area.

As agreed at our meeting on January 3, this information is to be kept strictly on a top executive level. It is definitely not to be distributed to the field.

It is with this understanding that the attachments are sent to you.

HMB

2/7/68

JM

General Headquarters
February 5, 1968

H. M. Ball

Herb:

Attached is a progress report on our environmental health project in the asbestos-cement area.

In line with our agreement at the January 3rd meeting of a/c pipe manufacturers, you may want to pass this report on to them.

If there are questions before so doing, please let me know.

F. J. Solon, Jr.

cc-Dr. George W. Wright, Cleveland,Ohio
M. Harris
J. Baker
W. P. Raines

PROGRESS REPORT
Environmental Health Project
Asbestos-Cement Pipe

At the conclusion of the January 3rd meeting of asbestos-cement pipe manufacturers, several of us volunteered for specific assignments. This is the first report of progress on those assignments.

Assignment: H. M. Ball to visit the General Counsel of the Cast Iron Pipe Research Association to discuss the desirability of eliminating reference to alleged health hazards in the promotion of various types of water pipe.

PROGRESS

Mr. Ball and Jay Baker carried out this assignment on January 18, meeting with both the General Counsel and the Executive Secretary of the Association at the Counsel's Washington, D.C. office. Mr. Ball has reported the successful results of that meeting to the other a/c pipe manufacturers. J-M Pipe Division people report no new "incidents" since that time.

Assignment: F. J. Solon, Jr. to visit Dr. Murray Brown of the U.S. Public Health Service to sound him out on what PHS plans to do about questions regarding the safety of a/c pipe and whether he would be receptive to the idea of broadening any PHS study to include cast iron, plastic and other types of pipe used to carry potable water.

PROGRESS

At a subsequent meeting with Dr. George W. Wright, Medical Consultant to the President of Johns-Manville, it was deemed advisable for Dr. Wright, who knows Dr. Brown well, to make the contact. He did so by phone the week of January 21. Dr. Brown told Dr. Wright he was aware of the problem, that Senator Gore of Tennessee had shown interest in it and that he (Dr. Brown) had an appointment with Dr. Stewart, the Surgeon General, that week and that the subject of a/c pipe could very well come up. He promised to report after his visit with Dr. Stewart.

He did not report that week so Dr. Wright called him January 31 to learn:

1. The subject did not come up in Dr. Brown's meeting with the Surgeon General.
2. If there is to be a test program on a/c pipe, it will probably be given to Dr. Brown's group - and that he has already made up his mind to include cast iron, plastic and other types of pipe in the program.
3. Dr. Brown has written to Dr. I. J. Selikoff asking for a copy of Dr. Selikoff's letter to Dr. Bistowish, Director of Health of Nashville and Davidson County. He is awaiting receipt of that letter before writing to Senator Gore, as the Senator had requested. He

has had no pressure from Senator Gore in the meantime and believes the political pressure is off.

In light of the above, it would not seem to be necessary for a delegation of a/c pipe manufacturers to visit Dr. Brown or anyone else in the PHS at this time regarding the inclusion of cast iron pipe, etc., in any test program. However, we will keep in touch with the situation through Dr. Wright so that should consideration of a test program become imminent, we will be on top of it and can then mutually decide strategy.

Assignment: Johns-Manville will prepare a position "background" paper on the a/c pipe environmental health question.

PROGRESS

The first rough draft has been completed. To the comments of Dr. Wright which form a firm base for this paper, we wanted to add those of Dr. Selikoff. Ivan Sabourin, Counsel to the Quebec Asbestos Mining Association, obtained from Dr. Selikoff a copy of the Selikoff letter to Dr. Bistowish along with his (Dr. Selikoff's) permission to give it to F. J. Solon, Jr. This gave us direct knowledge of the letter instead of the indirect knowledge we had had previously.

Now, in order to get "our own" letter of comment, Dr. Fred Pundsack of Johns-Manville who, with a group including

Mr. Sabourin, has been having exploratory scientific meetings with the Selikoff Mount Sinai group for several months, wrote to Dr. Selikoff on January 30th, requesting his comments on health aspects of a/c pipe. We understand that Dr. Selikoff will answer this request - so that in the next two weeks, we should have our own letter from which we can excerpt for our position "background" paper. If this works out as scheduled we should have a final position paper ready by March 1st.

Assignment: F.J. Solon, Jr. to talk with Dr. Wright re possible research programs on the a/c pipe health question.

PROGRESS

Dr. Wright contacted Dr. Robert T. deTreville of the Industrial Hygiene Foundation, Pittsburgh, where much asbestos fiber research has been and is being carried on. Dr. deTreville's letter to Dr. Wright with an attached report from Dr. Paul Gross, shows that in tests already underway, involving rat feeding, no abnormalities have yet been found in the gastro intestinal tracts of these animals in the 21 months since the test program began. This is encouraging and we hope this preliminary report will be borne out on the final report when all animals have been processed. We have no date as yet for this final report.

Since these tests involve chrysotile fiber only, Dr. Wright is now considering the advisability of a similar test program involving crocidilite fiber. This will be further discussed at a meeting on February 20.

Further on the Nashville "situation":

Attached are copies of two clippings from the Nashville Banner, January 17 and the Nashville Tennessean, January 19 showing that Dr. Bistowish is still openly opposing a/c pipe despite the point of view expressed in Dr. Selikoff's letter to him. At a meeting this past week with Moke Harris and Jay Baker of the J-M Pipe Division, we agreed on strategy aimed at getting the "full story" into the Nashville papers(i.e., Dr. Selikoff's letter to Dr. Bistowish which takes a much more temperate view of the hazard than Dr. Bistowish has thus far verbalized to the press and others.)

WATER CONTAMINATION STUDIES

At the January 3rd meeting we covered briefly the water test program we were getting underway at the Manville Research Center. Attached is a confirming memo from Ed Fenner, Director of our Environmental Control Department regarding that program.

Generally, I would say good progress is being made.

We will continue to report as that progress warrants.

F. J. Solon, Jr.

cc RD Gagnon 10/22

Mr. E. G. Farrell

AMERICAN SMELTING AND REFINING COMPANY
CENTRAL RESEARCH LABORATORIES
SOUTH PLAINFIELD, N.J. 07080

VAL KUDRYE
MANAGER, MINERALS RESEARCH

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October 10, 1968
Ref. 609

Mr. R. P. Gagnon
BLACK LAKE

Asbestos Textile Institute Meeting, Hershey, Pa.
October 2-4, 1968

An interesting and timely four-hour seminar on "Asbestos and Health" was included in the General Meeting. This was sponsored by Johns-Manville with C. L. Sheckler, Manager of Occupational Environmental Control, J-M Corp., as the Chairman. The seminar agenda, notes, and comments are as follows:

(A) News Headlines and Public Relations.

W. P. Raines, Director of Public Relations, Johns-Manville Corporation -

Presentations of "scare" newspaper and periodical headlines were made, including a recording of the audio portion of the CBS TV news presentation of June 7, 1968, in which asbestos in spray-up insulation on new building construction in New York City was being accused of being a potential health hazard to millions of people in the metropolitan New York area.

Johns-Manville Corporation has issued a set of three "Position Papers" on the subject, under the following titles:

1) "Asbestos - A Family of Minerals"

2) "Asbestos and The General Public"

3) "Asbestos and Human Health"

(B) Biological Effects of Asbestos

Dr. George W. Wright, St. Luke's Hospital, Cleveland, Ohio., Chairman, Institute of Environmental and Occupational Health.

The first cases reported in which asbestos was suspected of affecting the human lung were in 1900. In 1930 textile plants became concerned although the pathology was poorly described.

The first hard look at the problem concerned asbestosis and the second, the cancer producing proclivity resulting in bronchogenic cancer.

Asbestosis is associated with long-time exposure in which the lung shows scarring and inflammation. Biological effects show interference of movement of oxygen from gas phase of the lung to liquid phase in the blood. Measurement of this O2 movement is indicative of progress of scarring of the lung. Asbestosis results in lessening of elasticity of the lung and destroys the blood vessels of the lung.

The threshold limit value or maximum allowable concentration of dust particles has been 5 million particles per cubic foot of air, of particles less than 10 microns in diameter. This provisional limit is now inadequate and is being changed.

In Great Britain in 1950 it was found that the incidence of lung cancer was higher in asbestos workers suffering from asbestosis than in the non-asbestos workers. The asbestos producers in Canada had organized a study at the same time involving the mill workers of the Thetford area. This original study failed to show any undue frequency of lung cancer. However, it was shown that the only study data available were from relatively incomplete and sketchy death certificates.

This resulted in mandatory death certificate data showing detailed contrasting causes. Textile and friction material workers deaths were isolated, with both types showing earlier deaths than the rest of the population. Textile workers, because of high dustiness in textile plants,

showed higher incidences of earlier deaths. Cleaning up of textile mill dusty atmospheres in Great Britain resulted in a sharp decline in lung cancer.

A thin membrane covering the lung is the mesothelia. Abnormal calcification of the cells of the lining surface results in mesothelioma, classified as a rare tumor under ordinary circumstances. As few as two or three are seen in a lifetime by the average physician and only 1 in every 1000 lung tumors is a mesothelioma. But, in South African crocidolite and amosite workers, dozens of mesotheliomas have been found. Residents of the area, such as women not working with asbestos, have been found to be victims. Roads, in the crocidolite areas, contain fibers which filter through car windows are among the causative agents suspect.

Mesotheliomas are very rarely associated with chrysotile asbestos fibers for reasons not yet known.

It has been demonstrated that bronchogenic cancer is ten times as high in insulation workers as for equal age groups not employed in this type of work. Workers in the insulation trades exposed twenty or more years and who are cigarette smokers, are 90 times more susceptible than those not employed in the insulation industry and are non-smokers.

Fibers which stay in the lung and become tissue-coated are called "asbestos bodies". These are found in the lungs of the bulk of the population to a greater or lesser degree. The term may be misleading, however, in that the core of the asbestos body may be from a source other than asbestos, such as a manmade fiber, talc, or the like. Research is in progress to identify the origin of the "bodies" and to correlate this with disease and causes of death.

(C) Organizing and Engineering for Dust Control

E. M. Fenner, Director of Environmental Control, Johns-Manville Corporation -

Mr. Fenner discussed a typical method of improving dust control by illustration, showing the organizational make-up for improving the working conditions of textile workers at Manville, New Jersey.

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a) Determine Composition of Task Unit

1. Development Manager
2. Production Manager
3. General Plant Engineer
4. Manville Plant Engineer
5. Environmental Control Director

b) Task Team Goals

1. Correction of all operator stations where dust content is above Threshold Limit Value.
2. Correction of operations which create visible dust.
3. Improvements in methods for handling fiber.

c) Action - Master List

1. Process revision
2. Raw material change
3. Equipment modification
4. Improved dust collection
5. Improved housekeeping

(D) Asbestos Research Progress

Dr. L. J. Cralley, Director of Epidemiological and Field Studies, U.S. Public Health Service -

Portable X-ray units are being used in contacting all textile mills. Data is being collected for study.

Laboratory studies are in progress on fibers of both synthetic and natural origins.

An enzyme of benzopyrene is a harmful product found in the lungs. Magnesium is thought to activate this ion, while nickel, hexagonal chromium, manganese, cobalt and ferric iron tend to inhibit it.

Talcum powder cosmetics are frequently high in quartz, nickel and cobalt.

(E) Legislation, Litigation and Action Programs

C. L. Sheckler, Manager of Occupational Environmental Control, Johns-Manville Corporation -

CAPCO KIN 0000222

Several pieces of legislation are currently being debated. These are:

1) The Occupational and Safety Health Act of 1968
2) The Threshold Limit Value of Asbestos Dust.

The Occupational and Safety Health Act would grant special powers to the Secretary of Labor, establishing mandatory safety and health standards. The Secretary would not have to consult with employers, rather with other government committees only. Three hours of testimony have already been heard dealing only with asbestos, which has been damaging to the industry and has been slanted in the direction of labor. No attempt has been made to differentiate between types of asbestos, kinds of application, etc. It is essential that the American Textile Institute keep informed of this legislation.

The Threshold Limit Value of Asbestos Dust legislation is a forerunner to statutory changes in the present laws. It will reduce the current maximum value in industrial air from less than 5 million particles per cubic foot of air to less than 2 million particles per cubic foot of air. Impingement dust particle count methods have been found to be less efficient than membrane filters and new methods of establishing particle counts are to be used which are entirely different than those used before.

Great Britain has introduced new threshold limits which are far more stringent than those used in the United States.

The Unites States has proposed 12 fibers per cc over 5 microns, maximum.

For chrysotile and amosite, Great Britain has proposed for air, 2 fibers per cc and not more than 10 fibers per cc. Where 4 fibers per cc, inspectors will insist standards be improved. Where 10 cc or more, atmosphere will be considered dangerous and the conditions will be held unworkable.

For crocidolite, Great Britain has proposed limits of 0.1 of those for chrysotile and amosite.

In the Unites States, four potentially damaging lawsuits are in litigation at present, which could seriously effect the asbestos industry. An example of one is the case of a former Johns-Manville employee who worked at

Manville for 18 months in 1941 and 1942 as a clerk. He then quit to go into the armed services and when finished with his service, entered other employment. In 1966 he died of bronchogenic cancer and his estate sued, claiming his condition was incurred during his J-M employment. Defense lawyers claim they have a backlog of similar cases awaiting the outcome.

It was recommended that The American Textile Institute:

1) Initiate an environmental control committee of four people including top level production, marketing, a physician and an engineer which would keep abreast of health problems and coordinate information with industry.

2) Sponsor programs with other outside groups relating to health, such as Insulation Manufacturing, ACPA, Pearlite Institute, etc.

3) Assist member companies when requested.

4) Report in detail to the ATI general membership at each meeting or whenever required.

Technical Committee Meetings:

A combined meeting was held by the Fiber Testing Committe with the Technical Committee to discuss results of the Mapes and T&N Magnetic Rating round-robin tests run on asbestos textile products. It was concluded from the tests that:

1) There was no discernable difference in results between the two methods.

2) On either test, some companies got odd results on some samples.

3) Test variation between companies may be due to differences in the products or to differences in test procedures used or to a variation in packing in the test cell.

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It was decided to repeat the round-robin test program but to eliminate the test operator as a major variable. One man, familiar with both tests, will tour the member laboratories with test standards and test samples and instruct and observe the test procedures at each test location. A representative of Bell Mines will be used for this work.

Magnetite standards of the old 29A, Bureau of Standards material, has been used up. New standards are being checked against 29A and will be issued when tested.

The problem of determining objectionable grit in spinning fibers is being investigated by using wet cyclone separation methods. Results show good separation of the rejects from the long fiber, but it has not been determined that the long fiber is an acceptable spinning fiber by the trade. The textile companies will supply the committee with samples of objectionable portions of spinning fiber so that the test may be more closely controlled.

There is a need for more attention to the dust problem in fiber packaging such as bagging for overseas and domestic handling.

A sub-committee for color testing is required to more fully qualify terms, check new equipment, and investigate calibrating standards.

C. E. Stiefken

CES/lk

cc: M.J. Messel
L.C. Piuze
E.A. Farrell
K.W. Nelson
S.D. Weaver

CAPCO KIN 0000225

ASBESTOS TEXTILE INSTITUTE

Budget for 1968

Item	1967 Budget	Disbursements 12 months ending 9/11/67	Proposed Budget for 1968
Secretary's Salary	$ 1437.00	$ 1554.75 (*)	$ 1434.00
F.I.C.A. Tax	126.00	130.45	132.00
Secretary's travel	450.00	620.57	500.00
Office rent	900.00	975.00 (*)	900.00
Legal Retainer	2000.00	2000.00	2000.00
C.P.A. (Caruso)	300.00	300.00	300.00
Legal Travel & other expense	250.00	394.16	300.00
Meeting Expense (3 meetings)	2000.00	2709.16	2700.00
Exhibit expense	400.00	106.38	300.00
Handbook expense (3rd Ed.)	600.00	7680.43	------
Revision of ASTM Specs.	250.00	312.14	300.00
Insurance	-----	5.46	------
ASTM and I.N.F. dues	135.00	160.00	135.00
Office expense	1200.00	1328.40	1300.00
Incidentals	200.00	-----	200.00
B.& L. Dust Counting Equipmt	-----	-----	4814.00
Totals	$ 10248.00	$ 18276.90	$ 15315.00
Credit: Payments from members for Fibre Test Manuals and 3rd Edition Handbooks	------	9861.60	
		$ 8415.30	

Source of funds to meet 1968 Budget

Dues, Class "A" members ---- 5 @ $ 1000.00 ----------	$ 5000.00	
" " "B" members ---- 2 @ 500.00 ----------	1000.00	
" " "C" " ---- 4 @ 500.00 ----------	2000.00	
" " "D" " ---- 4 @ 250.00 ----------	1000.00	(**)
Book Sales to non-members ($492.25 in last 12 months)--	250.00	Est.
Interest on Savings Fund ($985.06 in last 12 months) --	750.00	Est.
By transfer from Savings Fund ----------	5315.00	
Total	$ 15315.00	

(*) 13 months

(**) Includes new associate member, Hilados Y Tejidos de Asbesto, S.A.

(*) Approved by B. of Gov. - 10/5/67

CAPCO KIN 0000226

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November 13, 1968

Mr. M. J. Massel
Black Lake

RE: Asbestos and Health

In case it has not already come to your attention, I am attaching a copy of an article on Asbestos and health which appeared on the front page of the Wall Street Journal on November 7.

Coming after the recent extensive article which appeared in the New Yorker, it would appear that this subject is coming up for more attention in the press.

E. L. Rimbault, Jr.

ELR:ls
Attachment

cc: RDBradford - w/enc.
KLWelson - w/enc.
EAFarrell - w/enc.

THE WALL STREET JOURNAL
Thursday, November 7, 1968

THREE STAR EDITION

Medical Researchers Study Role of Asbestos As Cause of Ailments

Men Who Work With It Have High Rate of Lung Ills; Dust Adds to Urban Air Pollution

By Ronald Kessler
Staff Reporter of The Wall Street Journal

Matthew Grossi walks up stairs backwards because he must sit and rest after each step. He can barely talk, and in recent years his weight has dropped to 120 pounds from a robust 190 pounds.

Mr. Grossi, 56 years old, has asbestosis, a lung ailment that seriously impairs his ability to breathe. Five years ago it was discovered that he also had lung cancer, but his doctors say that the tumor was removed successfully.

Doctors attribute Mr. Grossi's breathing difficulties and his development of lung cancer primarily to the large amount of asbestos dust he inhaled between 1941 and 1954, when he was a maintenance man at an asbestos factory near his home in Paterson, N.J. Even though he has had no contact with the material since he left that job the effects of breathing the asbestos dust are expected to stay with him for life.

Lung ailments directly associated with exposure to asbestos thus far have been limited to those who work with the heat and corrosion-resistant mineral, which is widely used in insulation and auto brake linings. Nevertheless, some scientists recently have singled out asbestos particles as a possibly dangerous ingredient in urban air pollution. Asbestos particles get into the air through the disintegration of asbestos products or when the material is sprayed on girders or beams of buildings during construction. According to one current theory, asbestos dust in human lungs acts as a sort of blotter, attracting and holding whatever harmful substances exist in cigaret smoke or urban air.

Protective Measures

Asbestos firms and Government agencies say they recognize asbestos dust as a potential health hazard. For many years, most asbestos-processing plants have employed various dust-control measures and required their production workers to wear protective face masks, industry sources say.

Johns-Manville Corp., the largest company in the field, last month announced it was entering a joint asbestos safety effort with the U.S. Public Health Service, the AFL-CIO International Association of Heat and Frost Insulators and Asbestos Workers and Mount Sinai School of Medicine of City University of New York. The main aim is to develop improved methods for reducing the exposure to asbestos dust of the estimated 200,000 workers in the industry.

But the scope of the research project could turn out to be broader. "If asbestos in the air is found to be generally harmful, we will want to protect the public from it, too," says F. J. Sayton Jr., a Johns-Manville vice president. The company adds that one new device being examined is a sprayer that won't unloose an asbestos-particle snowstorm when used out of doors on construction jobs.

Researchers agree that more study is needed into the health effects of asbestos dust. Right now, for instance, most scientists believe that present levels of asbestos dust in urban air aren't harmful, but they quickly add they aren't sure. Also, despite the blotter theory, scientists aren't sure how asbestos particles work to injure human lungs.

Research in Cape Town

However, the suspicion that asbestos dust can be dangerous to city dwellers was strengthened by recent research findings. Autopsies performed in several hospitals in New York, Montreal and Cape Town, South Africa, revealed asbestos particles in the lungs of between 25% and 50% of persons who died of many causes. Dr. J. C. Thomson, professor of pathology at Cape Town University, who conducted the South African studies, reported that the amount of the dust found in the lungs of asbestos workers wasn't much higher than that discovered in the lungs of the deceased urbanites who had never worked with the material. Thus, he concluded, small amounts of the particles might well be damaging.

It is well established that prolonged exposure to asbestos dust is harmful to asbestos workers. Asbestosis, the disease from which Mr. Grossi suffers, has been discovered only among asbestos workers or construction hands who frequently work with the material. Dr. Irving J. Selikoff of Mount Sinai Hospital in New York says that "nearly all" the men he has examined who have been production workers in asbestos plants for 15 years or more show "some degree" of asbestosis.

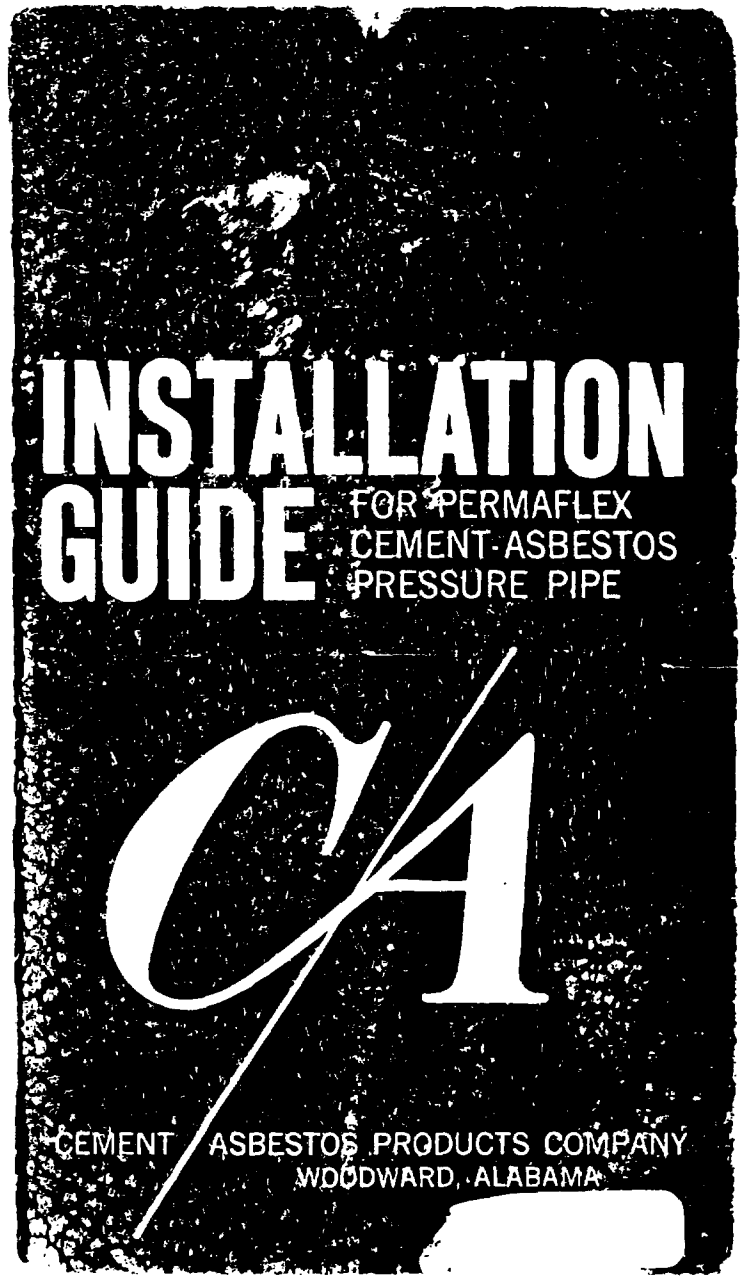
In addition, both asbestos production men and insulation handlers show a very high rate of mesothelioma, a rare type of cancer associated with asbestos dust. An estimated one in 13 asbestos workers dies of mesothelioma, compared with one in 16,000 of general population, studies show.

The most chilling statistic is that asbestos workers who are cigaret smokers have been found to die of all types of lung cancer at a rate 92 times that of nonsmokers in the general population. By comparison, smokers who aren't asbestos workers die of lung cancer at a rate 12 times that of nonsmokers. The extremely high rate of cancer deaths among asbestos workers who smoke has given rise to the theory that the dust acts to retain the cancer-causing ingredients believed by some scientists to be in cigaret smoke.

Researchers in the field hold out hope that the problem can be tackled successfully. They see no insurmountable obstacles to devising mechanical devices that can eliminate or sharply reduce the amount of dust generated by equipment that processes and applies asbestos. This would reduce future incidence of ailments linked to asbestos dust.

"I think we can lick this one," says E. Cuyler Hammond, a vice president of the American Cancer Society.

CAPCO KIN 0000228



CAPCO KIN 0000229

PERMAFLEX
INSTALLATION GUIDE

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

CAPCO KIN 0000230

CONTENTS

A	**General**	3
	Sizes	3
	Classes	3
B	**Preparations for Installation of Permaflex Pipe**	4
	Unloading	4
	Assorting of Damaged Pipe	4
	Stacking	5
C	**Trenching**	6
	Width of Trench	6
	Depth of Trench	7
	Line of Trench	7
	Trench Bottom	8
D	**Installation of Permaflex Pipe**	9
	Description of Coupling	9
	Assembly of Pipe and Coupling	10
	Cutting and Machining	12
E	**Service Connections**	
	Corporation Stops	13
	Tapped Couplings, Tapping Sleeves and Service Clamps	14
F	**Thrust Blocks**	14
G	**Backfilling and Tamping**	17
H	**Testing**	17
I	**How to Repair Damaged Pipe**	19
J	**Material Specification**	20
K	**Table of Dimensions**	32
L	**Flow Chart**	Inside Back Cover

INSTALLATION GUIDE

FOR PERMAFLEX* CEMENT-ASBESTOS PRESSURE PIPE

A GENERAL

Permaflex Pressure Pipe is manufactured in sizes from 4" to 16" in three classifications for use at 100, 150 and 200 psi. This classification specifies the permissible working pressure in psi up to which the pipe can be used.

Permaflex pipe meets the current AWWA, ASTM and Federal Specifications.

*REG. U. S. PAT. OFF.

CAPCO KIN 0000231

B PREPARATIONS FOR INSTALLATION OF PERMAFLEX PIPE

Efficient prework saves assembly costs, simplifies laying and increases the safety in service of Permaflex pipe.

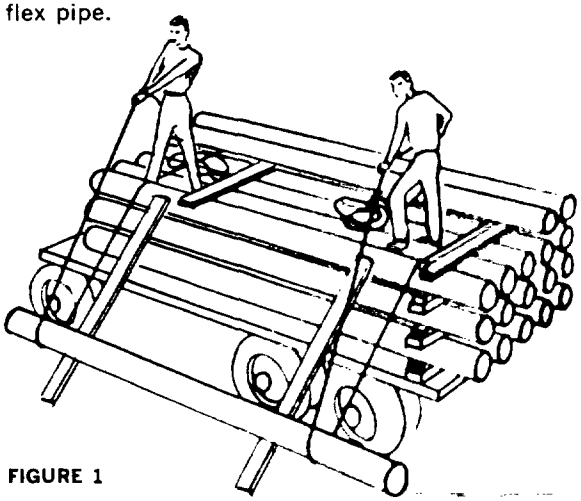


FIGURE 1

UNLOADING (See Figure 1)

Unloading of pipe up to 6" can be done manually without any mechanical help. Pipe larger than 6" in diameter is generally unloaded with skids and ropes. Two ropes should be used for lowering each pipe. Tie one end of each rope to the truck. Do not let pipe slide and do not drop it.

When using mechanical equipment for heavy pipe, use choker in center of pipe. Never insert hooks in end of pipe or coupling. Unload couplings carefully, never throw couplings from the truck.

ASSORTING OF DAMAGED PIPE

During unloading operations pipe is to be inspected as to any visible damage, such as breaks, cracks or chipped ends. Damaged pipe must be assorted and

stacked separately and damage is to be reported immediately.

If pipe is not immediately lined up alongside the trench, it should be stacked on level ground. Make sure that stop blocks are properly secured; timbers should be posted approximately 3 feet from pipe ends.

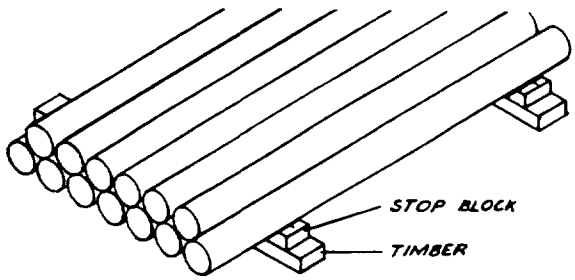


FIGURE 2

Couplings are usually delivered installed on pipe. Since direct sunlight might eventually damage the rubber rings, it is important that loose rings are not exposed to the sun for a long period of time. Store at a central point to avoid loss or pilfering. Keep away from oils or grease.

TRENCHSIDE DELIVERIES

Place pipe along side trench or trench site away from traffic. Along unopened trenches do not place pipe in path of excavating discharge. Never permit pipe unloading by one man from one end. Dropping one end of pipe while holding other end will result in breakage. Protect machined end of pipe from rocks, etc.

CAPCO KIN 0000232

C TRENCHING

As a general rule, trenches should not be opened too far ahead of pipe laying. Here are some of the reasons why long stretches of opened trench should be avoided: It minimizes the possibility of flooding the trench; it reduces caving caused by ground water; it helps prevent frozen trench bottom and backfill; it reduces hazards to traffic and workmen. Due to the light weight of the pipe and the simple assembly in the field, Permaflex pipe can generally be laid as fast as the trench is excavated.

WIDTH OF TRENCH

A wide trench at pipe level will increase the earthload on pipe whereas a narrow trench will slow down the laying of the pipe. Normally trench width is recommended by the project engineer to suit the soil conditions. In the absence of a specific recommendation by an engineer, the width at pipe level should be the same as shown in Table I.

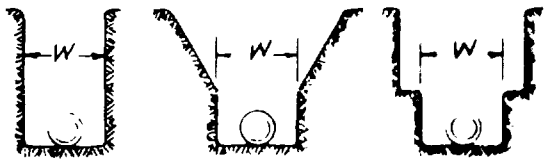


FIGURE 3

Recommended trench widths which are generally sufficient and also economical are listed in Table I.

TABLE I

Pipe diameter	Min. width of trench	Max. width of trench
4 inch	18 inch	28 inch
6 and 8 inch	20 inch	32 inch
10 and 12 inch	24 inch	36 inch
14 and 16 inch	30 inch	42 inch

DEPTH OF TRENCH

Like the trench width, the depth of the trench, too, has an important bearing on the cost of laying. Before excavating the trench, all factors should therefore be considered very carefully. For pressure lines this is determined with a minimum depth of cover over the pipe to give adequate protection against frost penetration. Also, due consideration must be given to surface loads and earth loads. The project engineer usually specifies the depth of cover.

LINE OF TRENCH

The Permaflex coupling is a flexible pipe connection and allows limited deflection of pipe.
The recommended maximum angles of deflection for the individual sizes are listed in Table II.

TABLE II

Pipe diameter	Recommended max. deflection
4"—12"	5°
14"—16"	4°

The pipe should be assembled in a normal straight line position. Deflection should be taken after assembly has been completed (see Figure 4).

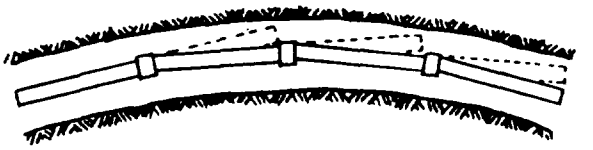
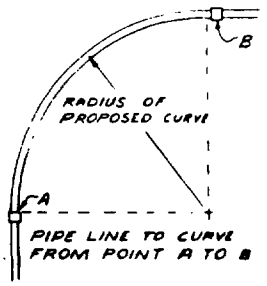


FIGURE 4

CAPCO KIN 0000233

MINIMUM RADIUS OF CURVATURE FOR PIPE ON CURVES



MINIMUM RADIUS OF CURVE (FEET) Length of Pipe (Feet) 3¼	6½	13	Deflection per Coupling (Degrees)	Offset per 13' Length (Inches)
186.7	373.5	747	1°	2.7"
92.7	185.5	371	2°	5.4"
62.0	124.0	249	3°	8.1"
46.5	93.1	186	4°	10.9"
37.1	74.3	149	5°	13.6"

TABLE III

TRENCH BOTTOM

Where conditions permit, the trench should be excavated to a flat bottom, cut true and even to the established grade. Where rock or other hard substances are present on the trench bottom, remove them to a depth of 6 inches deeper than the specified trench bottom and refill with well tamped earth or sand. Use a leveling board made from 2" x 4" at least 14 feet long to check for irregularities in the trench bottom. Any uneven areas in the trench bottom should be shaved off or filled in with well tamped earth. Recheck with the leveling board after filling.

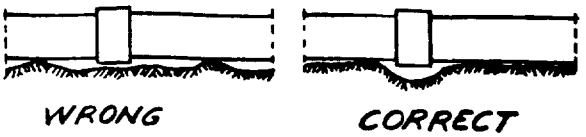
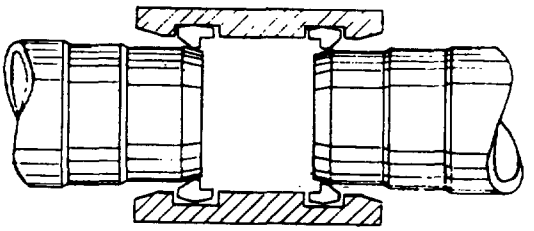


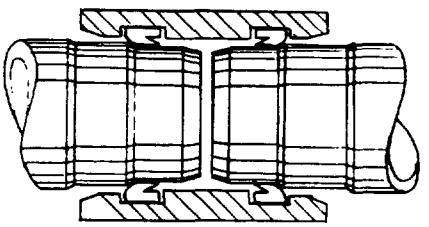
FIGURE 5

D INSTALLATION OF PERMAFLEX PIPE

The Permaflex coupling is a self sealing pipe connection. Its sealing rings simplify the installation and assure absolute sealing. Rising water pressure also increases the compression of the rings and thus the sealing security of the coupling (see Figure 6).



READY FOR ASSEMBLY



ASSEMBLY COMPLETED

FIGURE 6

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Normally Permaflex pipe is furnished with one gasket and coupling installed. Before installing the other gasket in field make sure the gasket groove is cleaned of any earth, sand, etc. Upon insertion of gasket run fingers around entire inside of gasket to make sure it is firmly seated without any twisting or bulging (see Figure 7).

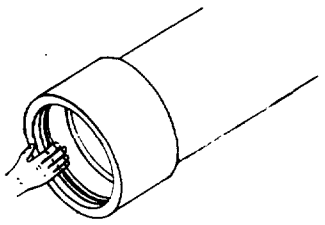


FIGURE 7

Clean coupling area of pipe. Apply lubricant over the machined end of the pipe (Figure 8) and surface of the rubber rings inside the coupling. To apply lubricant use a cloth or sponge. Use only lubricant supplied with pipe, never use grease or oils.

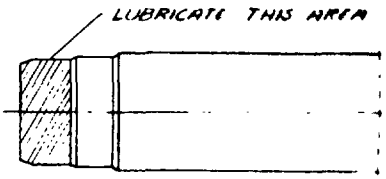


FIGURE 8

Small pipe may be handled by hand in trench and stabbed together as shown.

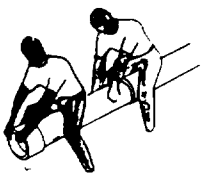


FIGURE 9

For medium sizes use crowbar and wooden block as demonstrated in Figure 10.

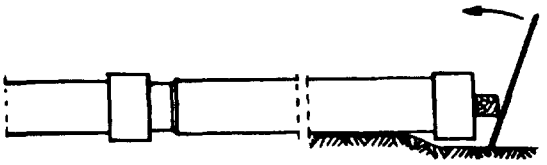


FIGURE 10

For larger sizes suspension may be used (Figure 11) so that the pipes' own weight forms a horizontal thrust component.
This saves considerable effort for the layer. A bar or pipe puller (or a combination of both) may be used to complete the assembly (Figure 12).

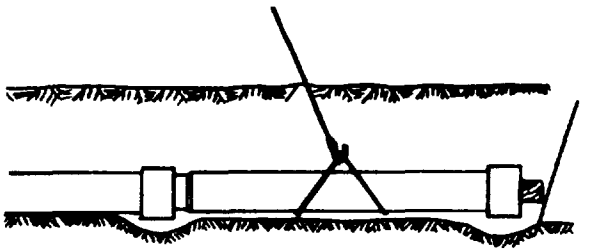


FIGURE 11

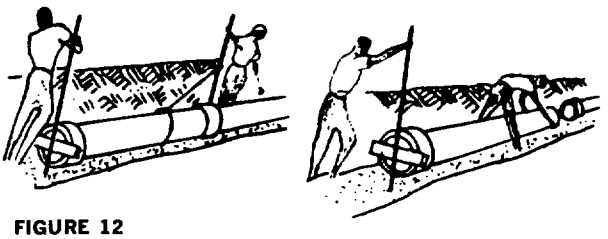


FIGURE 12

CAPCO KIN 0000235

The pipe to be assembled should be aligned carefully with the mating bell into which it will be inserted, any deflection required should be taken after assembly has been completed. A short positive swing of the pipe being assembled will drive it into proper assembled position, a solid feel of assembly is attained at this time, further forcing should not be attempted. Excess forces should not be used during assembly, if a solid feel is not attained, further inspection should be made for foreign material under the gasket, misalignment of pipe, gasket not properly installed, improper lubrication, etc.

CUTTING AND MACHINING

Small sizes can be cut quickly with a hand saw, otherwise a cutting machine such as shown in Figure 13 is used. If a fully machined pipe (MJA) is cut, the pipe bevel can be cut with rasp. Otherwise a coupling surface can be machined on the rough barrel of the pipe by using a machining tool such as shown.

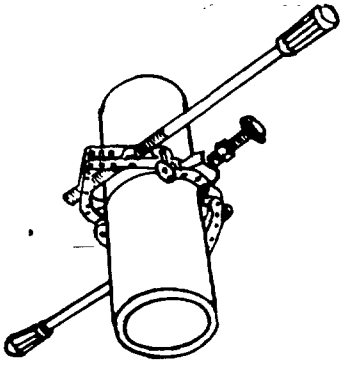


FIGURE 13
PIPE CUTTER

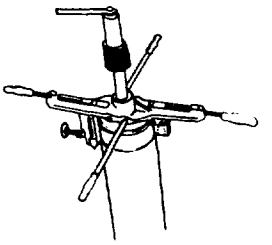


FIGURE 14
TOOL FOR MACHINING PIPE

E SERVICE CONNECTIONS

Corporation Stops

Maximum recommended sizes of corporation stops:

For 4" and 6" pipe —¾" Tap
For 8" and larger pipe— 1" Tap

Use only a clean and sharp tapping tool. Locate tap at about 45 degree angle, tap only deep enough to allow three threads exposed when the corporation stop is inserted (make a test tap and mark drilling bar). Do not tighten corporation stop more than necessary. Do not force the drill. Use a mixture of graphite and oil to lubricate stop and tap. Always put a bend or "gooseneck" between corporation stop and service pipe to allow for vibration, settling of soil, etc.

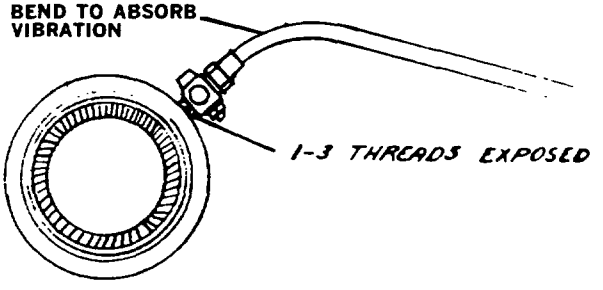


FIGURE 15

CAPCO KIN 0000236

If more than one corporation stop is used, they must be staggered at least 12" apart and not on the same center line.

Tapped Couplings, Tapping Sleeves and Service Clamps
For larger outlets tapped Permaflex couplings, service clamps or tapping sleeves are used. Double strap service clamps should be used when the outlet is over 1 inch. The following table contains the recommended maximum outlet sizes for use with service clamps.

TABLE IV

Maximum Size of Outlet Recommended with Service Clamps (Inches)

	Outlet Size (Classes 100-150-200)	
Pipe Size	Single Strap	Double Strap
4"		1"
6"		1½"
8"	2"	2"
10"	2"	2"
12"	2"	2"
14"	2"	2"
16"	2"	2"

F THRUST BLOCKS

Thrust blocks are provided to prevent the line from moving when pressure is applied. Any change of direction greater than 10° requires a thrust block. This includes all tees, wyes, valves, hydrants and caps. Various arrangements for thrust blocks are illustrated in Figure 16.

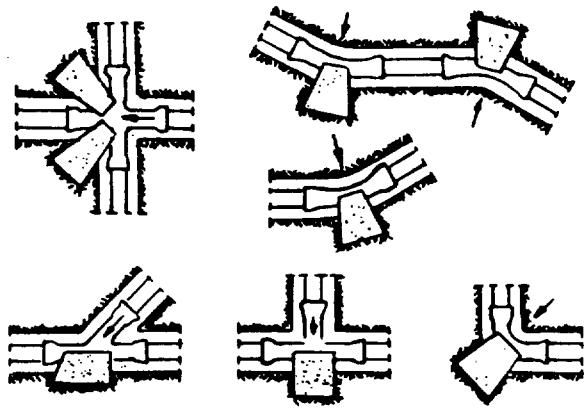


FIGURE 16

Permanent thrust blocks are generally made of concrete. Detachable blocks for pressure tests should be made of steel or wood. The size and type of thrust block depends on various factors such as: diameter of pipe, line pressure, type of fitting and kind of soil.
Table V lists the forces encountered at end closures. To calculate forces encountered at bends, tees and wyes, multiply the figure given in this table by the appropriate factor as listed following Table V.

TABLE V
Thrust W at End Closures

	Thrust in lbs. for test pressure in P.S.I.			
Pipe diam.	100 P.S.I.	150 P.S.I.	200 P.S.I.	250 P.S.I.
4"	1,820	2,720	3,630	4,540
6"	3,740	5,600	7,460	9,350
8"	6,490	6,819	13,000	16,200
10"	10,650	16,000	21,300	26,600
12"	15,150	22,700	30,200	37,800
14"	20,600	30,800	41,100	51,400
16"	26,600	39,800	53,100	66,400

CAPCO KIN 0000237

Elbows: 90° = 1.41 Tees = 0.70
60° = 1.00
45° = 0.76
30° = 0.52
22½° = 0.39

TABLE VI gives approximate horizontal bearing power of different soils. The thrust-block area is calculated as follows:

$$\text{Thrust-block area} = \frac{W}{F} = \frac{\text{Thrust (Table V)}}{\text{Soil bearing power (Table VI)}}$$

TABLE VI

Type of Soil	F = Horizontal bearing power in lb./sq. ft.
Sand	1000
Sand and gravel	1500
Clay and Marl	2000

Examples of Calculation

1st Example:

Thrust-block for end closure for 12" dia. line
Test pressure: 200 P.S.I.
Soil: Sand and gravel
Thrust (Table V) W = 30,200 P.S.I.
Soil bearing power (Table VI) F = 1500 lb./sq. ft.
Required thrust-block area $\frac{W}{F} = \frac{30,200}{1500}$
20.2 sq. ft.

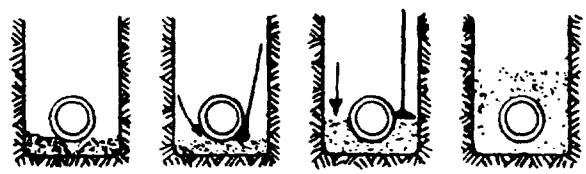
2nd Example:

Thrust-block for elbow 12" dia. 90°
Test pressure: 250 P.S.I.
Soil: Clay and marl
Thrust (Table V) W = 37,800 x 1.41 = 53,300 P.S.I.
Soil bearing power (Table VI) F = 2000 lbs.
Required thrust-block area = $\frac{W}{F} = \frac{53,300}{2000}$
26.65 sq. ft

G BACKFILLING AND TAMPING

Initial backfilling should be done as soon as possible after the pipe has been placed to protect the pipe from falling rocks, flooding and cave-ins. Provide a continuous bed by placing selected material under pipe and coupling and between the pipeline and the trench walls (Figure 17).

FIGURE 17



1. Place soil in 4" layers
2. Tamp under pipe at both sides
3. Add another 4" layer and tamp until half way up the pipe
4. Backfill by hand 12" over the pipe

Couplings are normally exposed until the line has been tested; initial backfill should proceed until the pipe has been covered by at least 12" of well selected material.
Water tamping may be used where drainage is good.

H TESTING

Pressure tests are generally carried out at an internal pressure of 50 P.S.I. above the actual operating pressure. Individual test sections should preferably not exceed 1000 ft. in length. Couplings should be uncovered for the test so that possible leaks are readily located. Before pressure testing, all parts of the pipeline have to be backfilled to prevent movement. All thrust-blocks should be in place and completely hardened. To insure that pipeline section is

CAPCO KIN 0000238

well vented, it should be filled at the lowest point of the line and an adequate venting port should be provided at the other end.

Dry cement-asbestos pipe is hydroscopic so that lines must be filled at least 24 hours prior to testing. Prior to final testing, again make sure that all entrapped air has been removed. All valves and hydrants must be closed. The pressure test is built up by using a hand pump or a small power pump. The quantity of water measured to maintain the test pressure is usually specified by the engineer.

TABLE VII

Allowable Leakage per 100 Couplings

Pipe Diameter in.	Test Pressure at Lowest Point in Line—psi						
	50	75	100	125	150	200	225
	Leakage—gph						
4	0.71	0.87	1.00	1.02	1.23	1.42	1.51
6	1.06	1.29	1.51	1.68	1.84	2.12	2.25
8	1.42	1.72	2.00	2.24	2.45	2.84	3.00
10	1.77	2.15	2.50	2.79	3.07	3.54	3.75
12	2.12	2.58	3.00	3.35	3.68	4.24	4.52
14	2.48	3.01	3.50	3.91	4.28	4.96	5.26
16	2.83	3.44	4.01	4.47	4.89	5.68	6.00

Table I from AWWA C603-64T

I HOW TO REPAIR DAMAGED PIPE

A bolted repair clamp may be used to repair bruises or cracks in the pipe wall. If the pipe has been broken cleanly into two pieces, the ends can either be joined together with a repair clamp or replaced.

If the coupling area of the pipe has been chipped or cracked more than ½'' from the end, the damaged area has to be cut off at least 1'' beyond the defect and the pipe end has to be remachined.

Scratches not over 1/16'' deep and ½'' wide can be sanded smooth so that the rubber rings will seat properly on the pipe. Deeper scratches or gouges will prevent the ring from sealing properly.

Therefore, the entire area should be cut off and the pipe end remachined.

If an undamaged pipe section must be replaced with insertion of fittings, couplings should be cut carefully to prevent damage to the machined section of pipe. Use hack saw, carpenter saw or cold chisel and hold tool parallel to pipe (see Figure 18).

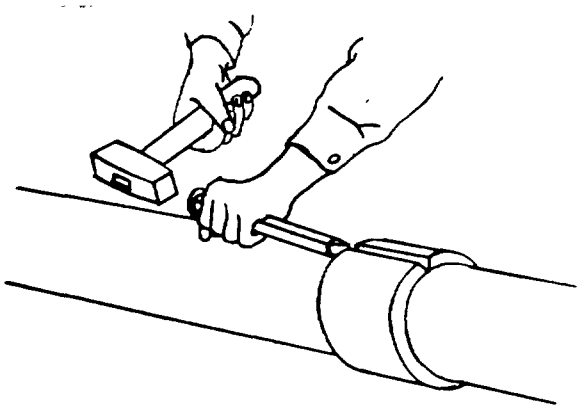


FIGURE 18

CAPCO KIN 0000239

MATERIAL SPECIFICATION

PERMAFLEX* ASBESTOS-CEMENT WATER PIPE

SECTION 1—SCOPE:

1.1 General: This specification designates the requirements for Permaflex* asbestos-cement water pipe manufactured for use in supply lines and distribution systems which carry water under pressure. This specification also designates the requirements for Permaflex asbestos-cement water pipe for use in sewer force mains which carry sewage under pressure.

SECTION 2—GENERAL REQUIREMENTS:

2.1 Sizes: Permaflex water pipe shall be manufactured with nominal inside diameters of 3, 4, 6, 8, 10, 12, 14, and 16 inches.

2.2 Classes: Permaflex water pipe shall be manufactured for use in service at maximum operating pressures of 100, 150, or 200 pounds per square inch. Pipe shall be designated as Class 100, 150, and 200, respectively, for the above maximum operating pressures.

2.3 Lengths:

2.31 Standard Lengths: The standard nominal length for Permaflex water pipe shall be 13 feet. A maximum of 10 percent of the total footage of any one size and class for any one order may be furnished, at the manufacturer's option, in pipe lengths shorter than 13 feet but not less than 7 feet. These shorter lengths shall be termed random lengths.

2.32 Short Lengths: Short lengths furnished for use in making rigid connections to fittings or structures shall not exceed 6 feet 6 inches.

*Reg. U.S. Pat. Off.

2.4 Couplings:

One Permaflex coupling shall be furnished with each standard, random and short length of pipe. It shall consist of an asbestos-cement sleeve and two solid rubber rings of uniform cross section and shall be suitable in size and design for the pipe with which it is used.

2.5 Materials:

2.51 Pipe and Permaflex Coupling: Permaflex water pipe and Permaflex coupling shall be composed of an intimate mixture of portland cement, silica and asbestos fiber and shall be free from organic substances.

2.52 Permaflex Coupling Rubber Rings: The rubber-ring gaskets shall consist of a vulcanized rubber compound.

SECTION 3—DETAIL REQUIREMENTS:

3.1 Pipe:

3.11 Description: Permaflex water pipe shall conform to the dimensions and tolerances given in Table I following. Each pipe shall be properly machined on each end so as to facilitate joining the pipe sections without damage and to provide end separation of pipes in each coupling assembly. The pipe ends shall also be compatible with the coupling so as to provide confinement of the rubber rings.

CAPCO KIN 0000240

TABLE I

DIMENSIONS OF PIPE AND COUPLING IN INCHES

Nom. Pipe Size	Class 100						
	D	D 2	D 3	D 5	D 6	D 8	D* 9
3	3.00	3.74	3.90	4.03	4.48	3.86	3.94
4	4.00	4.64	4.80	4.93	5.38	4.76	4.84
6	6.00	6.91	7.07	7.20	7.65	7.03	7.13
8	8.00	9.11	9.27	9.40	9.85	9.23	9.33
10	9.85	10.89	11.05	11.18	11.63	11.01	11.25
12	11.70	12.99	13.15	13.28	13.73	13.11	13.32
14	13.59	15.07	15.23	15.39	15.95	15.20	15.33
16	15.50	17.15	17.31	17.47	18.03	17.28	17.45

Nom. Pipe Size	Class 150						
	D	D 2	D 3	D 5	D 6	D 8	D* 9
3	3.00	3.84	4.00	4.13	4.58	3.96	4.10
4	4.00	4.81	4.97	5.10	5.55	4.93	5.01
6	5.85	6.91	7.07	7.20	7.65	7.03	7.13
8	7.85	9.11	9.27	9.40	9.85	9.23	9.33
10	10.00	11.66	11.82	11.95	12.40	11.78	11.88
12	12.00	13.92	14.08	14.21	14.66	14.04	14.14
14	14.00	16.22	16.38	16.54	17.10	16.35	16.48
16	16.00	18.46	18.62	18.78	19.34	18.59	18.72

*Subject to manufacturer's tolerances.

NOTE: See page 34 for key to dimensions.

Nom. Pipe Size	Class 200						
	D	D 2	D 3	D 5	D 6	D 8	D* 9
3	3.00	3.84	4.00	4.13	4.58	3.96	4.17
4	4.00	4.81	4.97	5.10	5.55	4.93	5.32
6	5.70	6.91	7.07	7.20	7.65	7.03	7.21
8	7.60	9.11	9.27	9.40	9.85	9.23	9.39
10	9.63	11.66	11.82	11.95	12.40	11.78	11.86
12	11.56	13.92	14.08	14.21	14.66	14.04	14.12
14	13.59	16.22	16.38	16.54	17.10	16.35	16.42
16	15.50	18.46	18.62	18.78	19.34	18.59	18.69

*Subject to manufacturer's tolerances.

Tolerances on Machined Portion of Pipe and Coupling in Inches

Pipe OD
D2 D3
3"-12": + .03-.03 14"-16": + .04-.04
Coupling ID
D6 D8
3"-12", + .03-.03 14"-16", + .04-.04
Length Tolerances
Std: + .0, -1.0 Short Lgths: ± ⅜

CAPCO KIN 0000241

3.12 Hydrostatic Strength: Each standard, random and short length of Permaflex water pipe shall be designed to have sufficient strength to withstand an internal hydrostatic pressure listed under Table II when applied as specified in Section 4.22.

TABLE II

A

Routine Hydrostatic Pressure, psi

Class	Test Pressure
100	350
150	525
200	700

B

Sampling Hydrostatic Test Pressure, psi

Class	Test Pressure
100	400
150	600
200	800

3.13 Flexural Strength: Each standard length of Permaflex water pipe in sizes 4, 6, and 8 inches shall have sufficient flexural strength to withstand, without failure, the total loads listed in Table III when applied at the third points of a 12-foot span for 13-foot lengths in the manner specified in Section 4.23.

TABLE III

Flexural Test Loads

Nominal Diameter In.	Class 100	Class 150	Class 200
	Total Applied Load—Lb.		
4	900	1,095	1,395
6	2,100	2,775	3,675
8	3,998	5,700	7,598

3.14 Crushing Strength: Permaflex water pipe shall have the crushing strength indicated in Table IV when tested in accordance with ASTM 3-Edge Bearing Method as specified in Section 4.24.

TABLE IV

Crushing Test Loads

Nominal Diameter In.	Class 100	Class 150	Class 200
	Applied Load per Foot of Length—Lb.		
3	4,600	6,700	8,800
4	4,100	5,400	8,700
6	4,000	5,400	9,000
8	4,000	5,500	9,300
10	4,400	7,000	11,000
12	5,200	7,600	11,800
14	5,200	8,600	13,500
16	5,800	9,200	15,400

3.2 Permaflex Coupling Sleeves:

3.21 Description: Permaflex coupling sleeves shall conform to the dimensions and tolerances listed in Table I. The inner surface of each sleeve shall be

CAPCO KIN 0000242

machined with gasket retaining grooves, so that when the joint is assembled the gasket shall be compressed to form a water-tight seal.

3.22 Hydrostatic Strength: Each Permaflex coupling sleeve shall be designed to have sufficient strength to withstand the internal hydrostatic pressures listed in Table II when applied as specified in Section 4.32.

3.3 Rubber Rings:
Rubber ring gaskets shall conform to the manufacturer's standards.

3.4 Chemical Requirements:
The uncombined calcium hydroxide present in Permaflex water pipe and Permaflex coupling sleeves shall not be more than 1%. When requested on the order, this test shall be conducted in accordance with the method described in Section 4.5.

SECTION 4—INSPECTION, TESTS AND REJECTIONS:

4.1 General: All material furnished under this specification shall be inspected and tested in a normal air-dry condition prior to shipment for conformance to the requirements stated in previous sections. When required on his order, the purchaser may witness inspection and test procedures at his own expense. In lieu of this, he may request the manufacturer to submit a certificate certifying the product meets the requirements of this specification.

4.2 Pipe:
4.21 Inspection: Before shipment, each pipe shall be inspected by the manufacturer for conformance to the dimensions and tolerances specified in Section 3.11.

4.22 Hydrostatic Test: Before shipment, each standard, random and short length of pipe in each size and class shall be tested hydrostatically to the routine test pressures specified in Table II-A by the manufacturer.
In addition, from each lot of 300 standard lengths of a given size and class which have passed the routine

test, the manufacturer shall select one section at random and test it to the sampling hydrostatic requirements listed in Table II-B and subsequently retest it to the pressure specified in Table II-A. If any pipe fails to withstand this sampling test, five additional lengths shall be selected and tested. Failure of two of these additional lengths to meet the specified requirements will necessitate rejection of the entire lot of pipe represented.
The test listed in Table II shall be conducted by placing the pipe in a hydrostatic testing machine which seals the pipe ends. All air shall be expelled and the internal pressure increased at a uniform rate of not less than 100 psi per second to the test pressures specified in Table II. The test pressures specified in Table II shall be maintained for a period of 5 seconds.

4.23 Flexural Test: Before shipment, each 13′ standard length of pipe in sizes 4, 6, and 8 inches shall be tested in flexure by the manufacturer for compliance with the flexure strength requirements specified in Section 3.13. The length of pipe shall be supported on a standard flexure testing machine with supports 12-feet apart for the 13-foot lengths. The total load shall be divided equally and applied at third points of the clear span at a minimum rate of at least 500 pounds per second and shall be maintained for 5 seconds.
Each pipe so tested shall support the applicable load without evidence of cracks or other defects.

4.24 Crushing Test: Before shipment, crushing tests shall be conducted by the manufacturer when requested by the purchaser on his order. One specimen length of pipe shall be selected from each lot of 300 lengths of each size and class of pipe or fraction thereof. From the specimen pipe there shall be cut one unmachined section of pipe one-foot long. This section shall be tested in crushing by the ASTM 3-Edge Bearing Method and shall not fail until the total applied load exceeds the tabular value

CAPCO KIN 0000243

given in Table IV for the size and class of pipe being tested. After 75 percent of the specified load is reached, the load shall be applied at a uniform rate of approximately 2000 pounds per minute.

If any specimen tested for crushing strength is less than 100 percent of the crushing load required in Section 3.14, one specimen cut from each of two additional pipe sections of the same lot shall be subjected to the crushing test.

The failure of one of these additional specimens to meet the crushing strength requirements of Section 3.14 shall be cause for rejection of the entire lot of pipe represented.

4.3 Permaflex Coupling Sleeves:

4.31 Inspection: Before shipment, each Permaflex coupling sleeve shall be inspected by the manufacturer for conformance with the dimensions and tolerances specified in Section 3.21.

4.32 Hydrostatic Test: Before shipment, each Permaflex coupling sleeve shall be tested hydrostatically by the manufacturer to the routine Hydrostatic Test pressures specified in Section 3.22 and Table II-A. In addition, from each lot of 300 couplings of a given size and class which have passed the routine test, the manufacturer shall select one at random and test it to the sampling hydrostatic requirement specified in Section 3.22 and Table II-B and subsequently retest it to the pressures specified in Table II-A. If any coupling fails to withstand this sampling test, five additional couplings shall be selected and tested. Failure of two of these additional couplings to meet the specified requirement will necessitate rejection of the entire lot of couplings represented. The tests listed in Table II shall be conducted by placing the coupling in a hydrostatic testing device designed to subject the coupling to internal bursting pressure. The pressure shall be increased at a steady rate of at least 100 psi per second to the test pressure specified in Table II and held at the test pressure for 5 seconds.

4.4 Permaflex Coupling Rubber Rings:

4.41 Inspection: Rubber ring gaskets shall be inspected by the manufacturer, before shipment, for compliance with the manufacturer's standards.

4.5 Uncombined Calcium Hydroxide Test:

Before shipment, when requested on the order, the Uncombined Calcium Hydroxide Test shall be conducted on one representative sample by the method described in this section.

4.51 Reagents:

A. Phenolphthalein Indicator—Dissolve 1 g of phenolphthalein in 100 ml of absolute ethanol.

B. Glycerol — Ethanol Solvent — Prepare a solution consisting of glycerol: anhydrous or absolute ethanol—1:2 by volume (commercial solvents consisting of 95% absolute ethanol and 5% isopropanol may be substituted). To each liter of this mixture 2 ml of the indicator is added. Adjust the solvent to slightly basic with either dilute NaOH in absolute ethanol or standard ammonium acetate, depending on the original pH.

C. Standard Ammonium Acetate Solution (1 ml= 0.005 g CaO) Dissolve 16g dry crystalline ammonium acetate in one liter of absolute or anhydrous ethanol. The solution is standardized against known amount of pure CaO by titrating a mixture of 0.05-0.06 g ground CaO, 60 ml of the glycerol-ethanol solvent, and 2 g of anhydrous strontium nitrate $Sr(NO_3)_2$ to a colorless end point. When the solution is boiled for 10 minutes, no color should appear. If color appears, continue titration.

4.52 Procedure: Representative samples of pipe or sleeve shall be prepared and immediately screened through a 20 mesh screen. Place the material passing through the screen immediately into a weighing bottle and cover with its ground glass top.

Place the bottle with top removed into a drying oven at 105° C for 2 hours and then cool in a desiccator to room temperature.

CAPCO KIN 0000244

eigh out 1 g ± 0.010 g of the prepared sample to the nearest 0.001 g, and place it into a dry 250 Erlenmeyer flask, to which a teflon encapsulated stirring bar, 60 ml of the glycerol-ethanol reagent and 2 g of $Sr(NO_3)_2$ are added. Attach flask to a water-cooled condenser (with standard 24/40 glass joint) and place on hot plate-magnetic stirrer. Boil the solution gently for 30 minutes with mild stirring, then remove the flask and filter the mixture on a Buchner funnel under vacuum. Bring filtrate to a boil and titrate with standardized ammonium acetate to the end point. The end point is observed by comparison with a similar mixture containing no phenolphthalein indicator. No excess ammonium acetate should be added at any time, because an excess may react with calcium silicates and aluminates.

4.53 Calculation:

A. Standardization of Ammonium Acetate Solution

$$E = \frac{W_{CaO}}{Va} \times 1.32$$

where E = weight of $Ca(OH)_2$ in g/ml of Ammonium Acetate solution

W_{CaO} = weight of CaO in grams

Va = volume of Ammonium Acetate in ml

B. Percentage of Uncombined $Ca(OH)_2$, in % = $\frac{EV}{W} \times 100$

where V = Volume of Ammonium Acetate solution required by sample in ml

W = Weight of sample in grams to nearest 0.001.

SECTION 5—MARKING:

5.1 Pipe: Each standard length and each random and short length of pipe shall be marked with the manufacturer's name, trade name "Permaflex," nominal size, class, hydrostatic test pressure, a "T" to signify it was tested, and date of manufacture.

5.2 Coupling Sleeves: Each Permaflex coupling sl be marked by the manufacturer with the manufacturer's identification, the size, the class of pipe with which it shall be used, and with a "T" to signify it has been hydrostatically tested.

5.3 Rubber Rings: Each Permaflex rubber ring shall be marked with the manufacturer's identification, the size, the year of manufacture, and the classes of pipe with which it can be used.

SECTION 6—PREPARATION FOR SHIPMENT:

6.1 General:

Permaflex water pipe and couplings shall be prepared for standard commercial shipment so as to assure acceptance by common or other carriers.

SECTION 7—SUPPLEMENTARY DETAILS TO BE SPECIFIED BY PURCHASER:

7.1 General: When purchasing Permaflex water pipe under these specifications, the purchaser shall supplement them with the following specific requirements for each lot of pipe.

7.2 Laying Length: The purchaser shall state the total laying length of each size and class of pipe required.

7.21 Short Lengths: The purchaser shall state the total footage of short lengths which shall be required for making rigid connections to fittings and structures and for making closures as described in Section 2.32.

7.3 Coating of Pipe and Couplings: When the purchaser requires that the interior surface of the pipe and couplings be coated with a bituminous seal coating, he shall so state on his order.

7.4 Inspection and Tests: When the purchaser wishes to witness the inspection and tests conducted by the manufacturer, he shall so state on his order so that the manufacturer can notify the purchaser in ample time. All expense incidental to this inspection shall be assumed by the purchaser.

CAPCO KIN 0000245

7.41 Certificate of Test: When the purchaser requires a certificate of test in lieu of witnessing the inspection and test procedures, he shall so state on his order.

7.42 Crushing Tests: When the purchaser requires that the crushing tests be conducted on pipe, he shall so state on his order.

7.43 Uncombined Calcium Hydroxide Tests: When the purchaser requires that the Uncombined Calcium Hydroxide Tests be conducted, he shall so state on his order.

TABLE OF DIMENSIONS

CLASS 100

ALL CLASSES

PIPE SIZE	D	D2 D4	D3	D5	D6	D7	D8	D9	N	Q	C	E	T
3	3.00	3.74	3.90	4.03	4.48	5.38	3.86	3.94	6.25	1.00	1.87	3.37	.62
4	4.00	4.64	4.80	4.93	5.38	6.20	4.76	4.84	6.25	1.00	1.87	3.37	.62
6	6.00	6.91	7.07	7.20	7.65	8.26	7.03	7.13	6.25	1.00	1.87	3.37	.62
8	8.00	9.11	9.27	9.40	9.85	10.46	9.23	9.33	7.00	1.00	2.25	3.75	.75
10	9.85	10.89	11.05	11.18	11.63	13.02	11.01	11.25	7.00	1.00	2.25	3.75	.75
12	11.70	12.99	13.15	13.28	13.73	15.28	13.11	13.32	7.00	1.00	2.25	3.75	.75
14	13.59	15.07	15.23	15.39	15.95	17.49	15.20	15.33	8.00	1.06	2.62	4.25	1.00
16	15.50	17.15	17.31	17.47	18.03	19.74	17.28	17.45	8.00	1.06	2.62	4.25	1.00

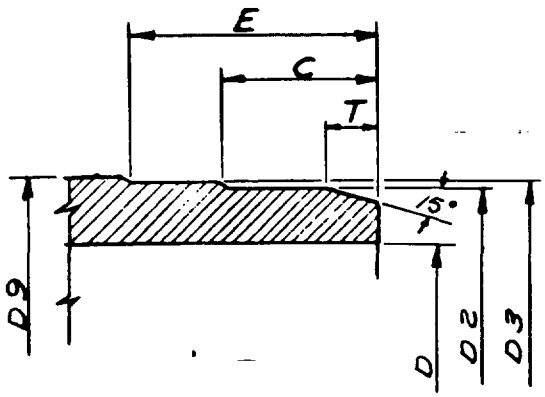
CLASS 150

PIPE SIZE	D	D2 D4	D3	D5	D6	D7	D8	D9	LENGTH OF PIPE
3	3.00	3.84	4.00	4.13	4.58	5.58	3.96	4.10	STANDARD: 13'-0"
4	4.00	4.81	4.97	5.10	5.55	6.50	4.93	5.01	HALF LENGTHS: 6'-6"
6	5.85	6.91	7.07	7.20	7.65	8.90	7.03	7.13	QUARTER LENGTHS: 3'-3"
8	7.85	9.11	9.27	9.40	9.85	11.25	9.23	9.33	STANDARD LENGTHS MEE
10	10.00	11.66	11.82	11.95	12.40	14.30	11.78	11.88	HALF LENGTHS MEE
12	12.00	13.92	14.08	14.21	14.66	16.75	14.04	14.14	QUARTER LENGTHS MOA
14	14.00	16.22	16.38	16.54	17.10	19.50	16.35	16.48	GASKETS ARE MARKED FOR—
16	16.00	18.46	18.62	18.78	19.34	22.00	18.59	18.72	SIZES & CLASSES

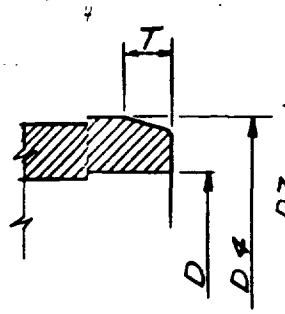
CAPCO KIN 0000246

CLASS 200

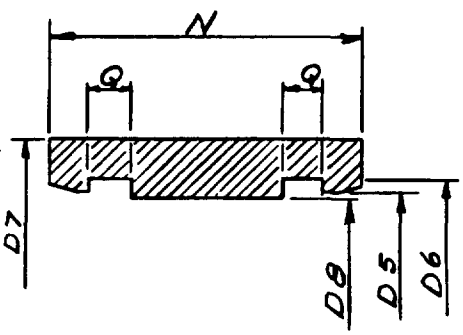
PIPE SIZE	D	D2: D4	D3	D5	D6	D7	D8	D9	TOLERANCES
3	3.00	3.84	4.00	4.13	4.58	5.58	3.96	4.17	DIMS. D_2, D_3, D_4, D_5, D_6, & D_8
4	4.00	4.81	4.97	5.10	5.55	6.71	4.93	5.32	3"—12" +.03 -.03
6	5.70	6.91	7.07	7.20	7.65	9.01	7.03	7.21	14"—16" +.04 —.04
8	7.60	9.11	9.27	9.40	9.85	11.41	9.23	9.39	DIMS. D_7, D_9 & N
10	9.63	11.66	11.82	11.95	12.40	14.40	11.78	11.86	SUBJECT TO MFGR. TOLERANCE
12	11.56	13.92	14.08	14.21	14.66	16.94	14.04	14.12	ANGLE ± 2°
14	13.59	16.22	16.38	16.54	17.10	19.84	16.35	16.42	LENGTH OF PIPE +.00 —1.0
16	15.50	18.46	18.62	18.78	19.34	22.41	18.59	18.69	SHORT PIECES +.00 —0.375



STANDARD LENGTH



SHORT LENGTH



PERMAFLEX COUPLING

CAPCO KIN 0000247

FLOW OF WATER IN PERMAFLEX PIPE

NOTE: Loss of head values on this chart are for coefficient of flow C = 140. These may be converted to head loss for other coefficients by using the following multiplying factors:

1.15 for C = 130
1.34 for C = 120
1.57 for C = 110
1.86 for C = 100

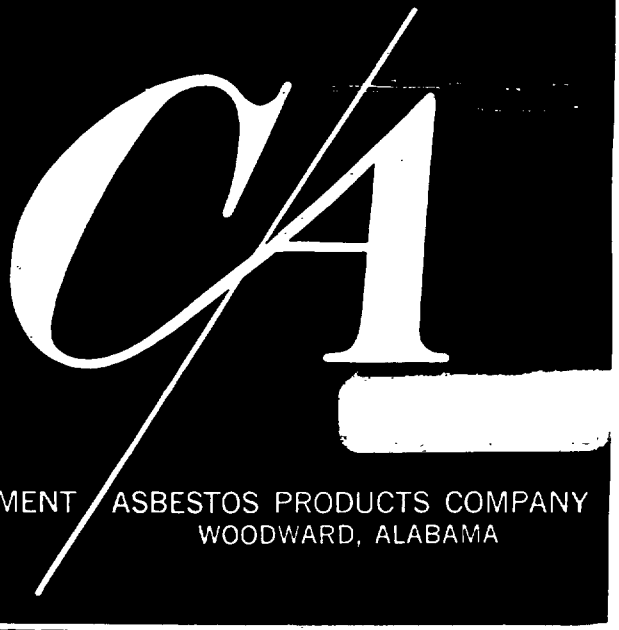
1 ft head = .433 P.S.I.
1 P.S.I. = 2.309 ft. head

CAPCO KIN 0000248

FLOW OF WATER IN PERMAFLEX PIPE

INSTALLATION GUIDE

FOR PERMAFLEX CEMENT-ASBESTOS PRESSURE PIPE



CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA

CAPCO KIN 0000250

PERMAFLEX
INSTALLATION GUIDE

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

CAPCO KIN 0000251

CONTENTS

Specifications for Asbestos-Cement Pipe (Short Form)		3
A	**General**	4
	Sizes	4
	Classes	4
B	**Preparations for Installation of Permaflex Pipe**	5
	Unloading	5
	Assorting of Damaged Pipe	5
	Stacking	6
C	**Trenching**	7
	Width of Trench	7
	Depth of Trench	8
	Line of Trench	8
	Pipe Laid on Trench Bottom	9
	Pipe Laid on Earth Pads	10
D	**Installation of Permaflex Pipe**	11
	Description of Coupling	11
	Assembly of Pipe and Coupling	12
	Cutting and Machining	14
E	**Service Connections**	
	Corporation Stops	15
	Tapped Couplings, Tapping Sleeves and Service Clamps	16
F	**Thrust Blocks**	16
G	**Backfilling and Tamping**	19
H	**Testing**	19
I	**How to Repair Damaged Pipe**	21
J	**Material Specification**	22
K	**Table of Dimensions**	34
L	**Flow Chart**	Inside Back Cover

SHORT FORM

SPECIFICATIONS

FOR ASBESTOS-CEMENT PIPE

ASBESTOS-CEMENT PIPE:

A. Asbestos-cement pipe shall be Class 150 PERMAFLEX® Water Pipe as manufactured by Cement Asbestos Products Company or equal. One PERMAFLEX® coupling shall be furnished with each standard, random, and short length of pipe. It shall consist of an asbestos-cement sleeve and two solid rubber rings of uniform cross section and shall be suitable in size and design with the pipe with which it is used. The rubber ring gaskets shall consist of a vulcanized rubber compound. All pipe shall conform to AWWA C400-65, and all pipe shall be furnished in 13-foot lengths.

B. Hydrostatic Test: Each standard, random, and short length of PERMAFLEX® water pipe shall be designed to have sufficient strength to withstand an internal hydrostatic pressure of 525 psi. Flexural and crushing strength tests shall be performed on PERMAFLEX® pipe as required in AWWA C400-65.

C. Chemical Requirements: The uncombined calcium hydroxide present in PERMAFLEX® water pipe and PERMAFLEX® couplings shall not be more than 1%.

D. Inspection: Before shipment, each standard, random, and short length of pipe in each size and class shall be tested by the manufacturer as stated above. Pipe shall be inspected in the normal air-dry condition.

CAPCO KIN 0000252

INSTALLATION GUIDE

FOR PERMAFLEX* CEMENT-ASBESTOS PRESSURE PIPE

A GENERAL

Permaflex Pressure Pipe is manufactured in sizes from 4" to 16" in three classifications for use at 100, 150 and 200 psi. This classification specifies the permissible working pressure in psi up to which the pipe can be used.

Permaflex pipe meets the current AWWA, ASTM and Federal Specifications.

*REG. U. S. PAT. OFF.

B PREPARATIONS FOR INSTALLATION OF PERMAFLEX PIPE

Efficient prework saves assembly costs, simplifies laying and increases the safety in service of Permaflex pipe.

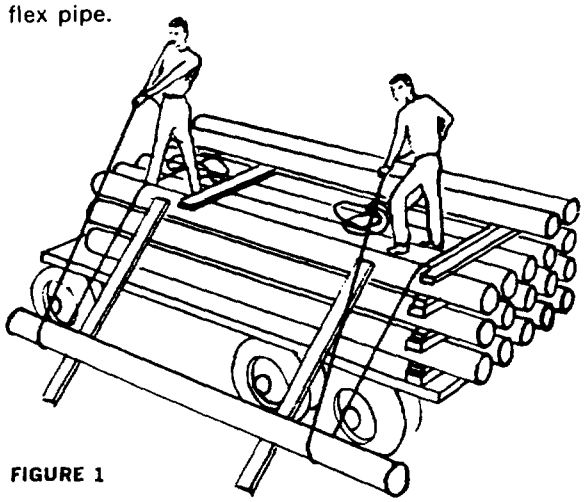


FIGURE 1

UNLOADING (See Figure 1)

Unloading of pipe up to 6" can be done manually without any mechanical help. Pipe larger than 6" in diameter is generally unloaded with skids and ropes. Two ropes should be used for lowering each pipe. Tie one end of each rope to the truck. Do not let pipe slide and do not drop it.

When using mechanical equipment for heavy pipe, use choker in center of pipe. Never insert hooks in end of pipe or coupling. Unload couplings carefully, never throw couplings from the truck.

ASSORTING OF DAMAGED PIPE

During unloading operations pipe is to be inspected as to any visible damage, such as breaks, cracks or chipped ends. Damaged pipe must be assorted and

CAPCO KIN 0000253

stacked separately and damage is to be reported immediately.

If pipe is not immediately lined up alongside the trench, it should be stacked on level ground. Make sure that stop blocks are properly secured; timbers should be posted approximately 3 feet from pipe ends.

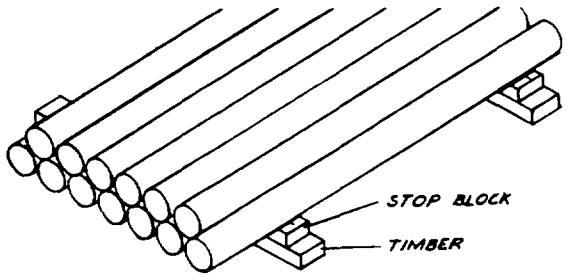


FIGURE 2

Couplings are usually delivered installed on pipe. Since direct sunlight might eventually damage the rubber rings, it is important that loose rings are not exposed to the sun for a long period of time. Store at a central point to avoid loss or pilfering. Keep away from oils or grease.

TRENCHSIDE DELIVERIES

Place pipe along side trench or trench site away from traffic. Along unopened trenches do not place pipe in path of excavating discharge. Never permit pipe unloading by one man from one end. Dropping one end of pipe while holding other end will result in breakage. Protect machined end of pipe from rocks, etc.

C TRENCHING

As a general rule, trenches should not be opened too far ahead of pipe laying. Here are some of the reasons why long stretches of opened trench should be avoided: It minimizes the possibility of flooding the trench; it reduces caving caused by ground water; it helps prevent frozen trench bottom and backfill; it reduces hazards to traffic and workmen. Due to the light weight of the pipe and the simple assembly in the field, Permaflex pipe can generally be laid as fast as the trench is excavated.

WIDTH OF TRENCH

A wide trench at pipe level will increase the earthload on pipe whereas a narrow trench will slow down the laying of the pipe. Normally trench width is recommended by the project engineer to suit the soil conditions. In the absence of a specific recommendation by an engineer, the width at pipe level should be the same as shown in Table I.

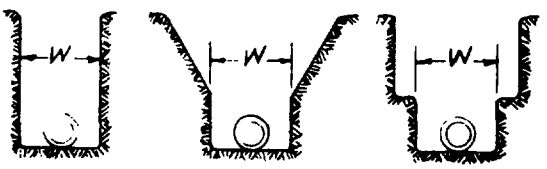


FIGURE 3

Recommended trench widths which are generally sufficient and also economical are listed in Table I.

TABLE I

Pipe diameter	Min. width of trench	Max. width of trench
4 inch	18 inch	28 inch
6 and 8 inch	20 inch	32 inch
10 and 12 inch	24 inch	36 inch
14 and 16 inch	30 inch	42 inch

CAPCO KIN 0000254

DEPTH OF TRENCH

Like the trench width, the depth of the trench, too, has an important bearing on the cost of laying. Before excavating the trench, all factors should therefore be considered very carefully. For pressure lines this is determined with a minimum depth of cover over the pipe to give adequate protection against frost penetration. Also, due consideration must be given to surface loads and earth loads. The project engineer usually specifies the depth of cover.

LINE OF TRENCH

The Permaflex coupling is a flexible pipe connection and allows limited deflection of pipe.
The recommended maximum angles of deflection for the individual sizes are listed in Table II.

TABLE II

Pipe diameter	Recommended max. deflection
4"—12"	5°
14"—16"	4°

The pipe should be assembled in a normal straight line position. Deflection should be taken after assembly has been completed (see Figure 4).

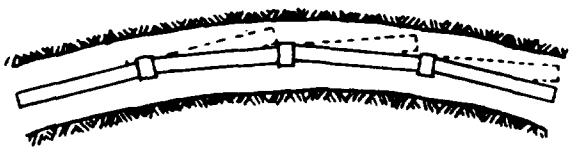
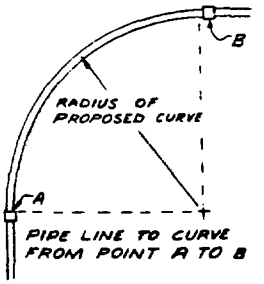


FIGURE 4

MINIMUM RADIUS OF CURVATURE FOR PIPE ON CURVES



MINIMUM RADIUS OF CURVE (FEET) Length of Pipe (Feet) 3¼	6½	13	Deflection per Coupling (Degrees)	Offset per 13' Length (Inches)
186.7	373.5	747	1°	2.7"
92.7	185.5	371	2°	5.4"
62.0	124.0	249	3°	8.1"
46.5	93.1	186	4°	10.9"
37.1	74.3	149	5°	13.6"

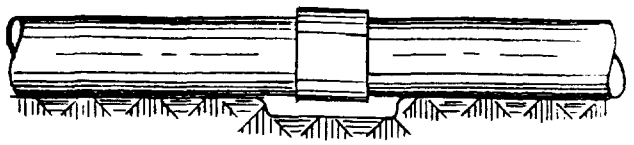
TABLE III

PIPE LAID ON TRENCH BOTTOM

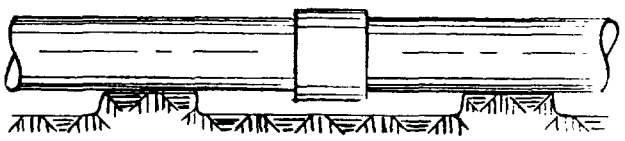
Where conditions permit, the trench should be excavated to a flat bottom, cut true and even to the established grade. Where rock or other hard substances are present on the trench bottom, remove them to a depth of 6 inches deeper than the specified trench bottom and refill with well tamped earth or sand. Use a leveling board made from 2" x 4" at least 14 feet long to check for irregularities in the trench bottom. Any uneven areas in the trench bottom should be shaved off or filled in with well tamped earth. Recheck with the leveling board after filling.

CAPCO KIN 0000255

FIGURE 5



PIPE LAID ON TRENCH BOTTOM



PIPE LAID ON EARTH PADS

PIPE LAID ON EARTH PADS

Earth pads may be used to support pipe and keep couplings up off hard bottom. These pads should be made from select backfill material, free from rocks, clay lumps, etc.

Space pads approximately 30 inches from each end of 13-foot pipe. On shorter length pipe, locate pads one-fifth of pipe length from each end. Pads should be a minimum of 12 inches wide, 2 inches high, and extend the complete width of the trench.

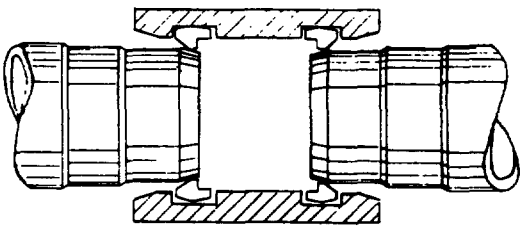
Place pipe on pads and check ends for alignment. Add or remove pad material as required to align pipe ends. Be sure pipe has a minimum of 2-inches clearance under unsupported area.

Begin backfilling as soon as possible.

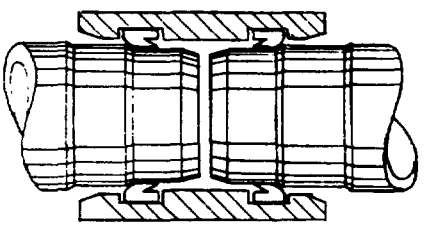
(See section "G," page 19).

D INSTALLATION OF PERMAFLEX PIPE

The Permaflex coupling is a self sealing pipe connection. Its sealing rings simplify the installation and assure absolute sealing. Rising water pressure also increases the compression of the rings and thus the sealing security of the coupling (see Figure 6).



READY FOR ASSEMBLY



ASSEMBLY COMPLETED

FIGURE 6

CAPCO KIN 0000256

Normally Permaflex pipe is furnished with one gasket and coupling installed. Before installing the other gasket in field make sure the gasket groove is cleaned of any earth, sand, etc. Upon insertion of gasket run fingers around entire inside of gasket to make sure it is firmly seated without any twisting or bulging (see Figure 7).

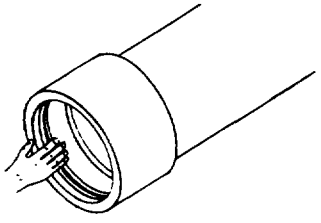


FIGURE 7

Clean coupling area of pipe. Apply lubricant over the machined end of the pipe (Figure 8) and surface of the rubber rings inside the coupling. To apply lubricant use a cloth or sponge. Use only lubricant supplied with pipe, never use grease or oils.

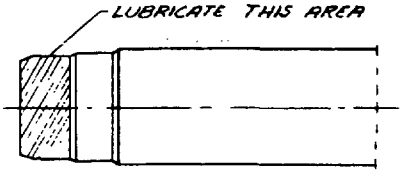


FIGURE 8

Small pipe may be handled by hand in trench and stabbed together as shown.

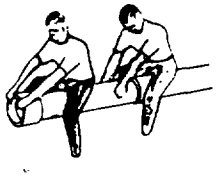


FIGURE 9

For medium sizes use crowbar and wooden block as demonstrated in Figure 10.

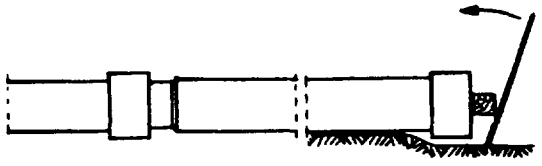


FIGURE 10

For larger sizes suspension may be used (Figure 11) so that the pipes' own weight forms a horizontal thrust component.
This saves considerable effort for the layer. A bar or pipe puller (or a combination of both) may be used to complete the assembly (Figure 12).

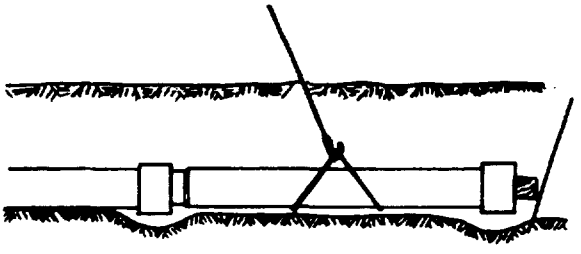


FIGURE 11

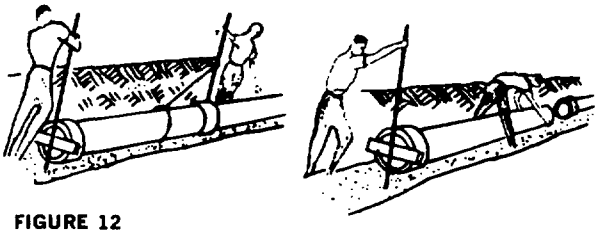


FIGURE 12

CAPCO KIN 0000257

The pipe to be assembled should be aligned carefully with the mating bell into which it will be inserted, any deflection required should be taken after assembly has been completed. A short positive swing of the pipe being assembled will drive it into proper assembled position, a solid feel of assembly is attained at this time, further forcing should not be attempted. Excess forces should not be used during assembly, if a solid feel is not attained, further inspection should be made for foreign material under the gasket, misalignment of pipe, gasket not properly installed, improper lubrication, etc.

CUTTING AND MACHINING

Small sizes can be cut quickly with a hand saw, otherwise a cutting machine such as shown in Figure 13 is used. If a fully machined pipe (MOA) is cut, the pipe bevel can be cut with rasp. Otherwise a coupling surface can be machined on the rough barrel of the pipe by using a machining tool such as shown.

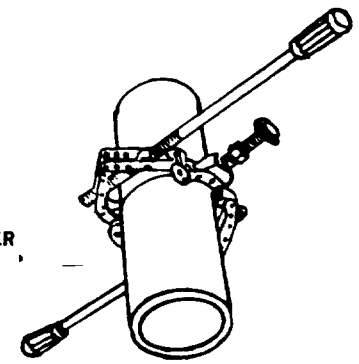


FIGURE 13
PIPE CUTTER

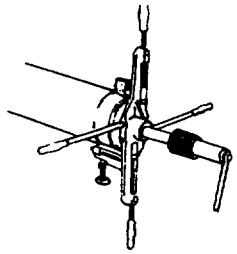


FIGURE 14
TOOL FOR MACHINING PIPE

E SERVICE CONNECTIONS

Corporation Stops

Maximum recommended sizes of corporation stops:

For 4" and 6" pipe —¾" Tap
For 8" and larger pipe— 1" Tap

Use only a clean and sharp tapping tool. Locate tap at about 45 degree angle, tap only deep enough to allow three threads exposed when the corporation stop is inserted (make a test tap and mark drilling bar). Do not tighten corporation stop more than necessary. Do not force the drill. Use a mixture of graphite and oil to lubricate stop and tap. Always put a bend or "gooseneck" between corporation stop and service pipe to allow for vibration, settling of soil, etc.

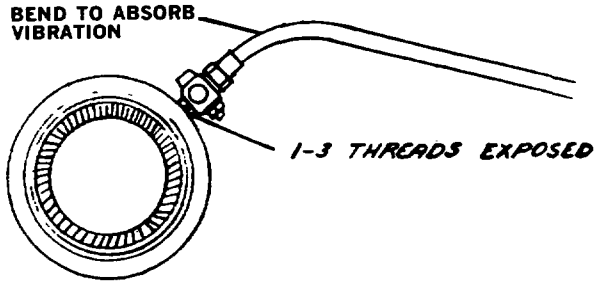


FIGURE 15

CAPCO KIN 0000258

If more than one corporation stop is used, they must be staggered at least 12" apart and not on the same center line.

Tapped Couplings, Tapping Sleeves and Service Clamps
For larger outlets tapped Permaflex couplings, service clamps or tapping sleeves are used. Double strap service clamps should be used when the outlet is over 1 inch. The following table contains the recommended maximum outlet sizes for use with service clamps.

TABLE IV

Maximum Size of Outlet Recommended with Service Clamps (Inches)

	Outlet Size (Classes 100-150-200)	
Pipe Size	Single Strap	Double Strap
4"		1"
6"		1½"
8"	2"	2"
10"	2"	2"
12"	2"	2"
14"	2"	2"
16"	2"	2"

F THRUST BLOCKS

Thrust blocks are provided to prevent the line from moving when pressure is applied. Any change of direction greater than 10° requires a thrust block. This includes all tees, wyes, valves, hydrants and caps. Various arrangements for thrust blocks are illustrated in Figure 16.

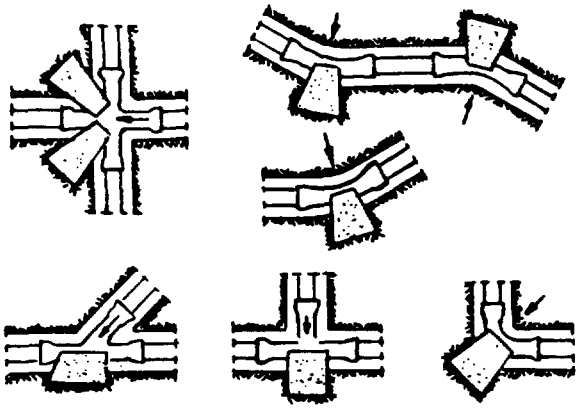


FIGURE 16

Permanent thrust blocks are generally made of concrete. Detachable blocks for pressure tests should be made of steel or wood. The size and type of thrust block depends on various factors such as: diameter of pipe, line pressure, type of fitting and kind of soil.
Table V lists the forces encountered at end closures. To calculate forces encountered at bends, tees and wyes, multiply the figure given in this table by the appropriate factor as listed following Table V.

TABLE V
Thrust W at End Closures

	Thrust in lbs. for test pressure in P.S.I.			
Pipe diam.	100 P.S.I.	150 P.S.I.	200 P.S.I.	250 P.S.I.
4"	1,820	2,720	3,630	4,540
6"	3,740	5,600	7,460	9,350
8"	6,490	6,819	13,000	16,200
10"	10,650	16,000	21,300	26,600
12"	15,150	22,700	30,200	37,800
14"	20,600	30,800	41,100	51,400
16"	26,600	39,800	53,100	66,400

CAPCO KIN 0000259

Factors for calculating thrust W for elbows and tees.

Elbows: 90° = 1.41 Tees = 0.70
60° = 1.00
45° = 0.76
30° = 0.52
22½° = 0.39

TABLE VI gives approximate horizontal bearing power of different soils. The thrust-block area is calculated as follows:

$$\text{Thrust-block area} = \frac{W}{F} = \frac{\text{Thrust (Table V)}}{\text{Soil bearing power (Table VI)}}$$

TABLE VI

Type of Soil	F=Horizontal bearing power in lb./sq. ft.
Sand	1000
Sand and gravel	1500
Clay and Marl	2000

Examples of Calculation

1st Example:

Thrust-block for end closure for 12" dia. line
Test pressure: 200 P.S.I.
Soil: Sand and gravel
Thrust (Table V) W = 30,200 P.S.I.
Soil bearing power (Table VI) F = 1500 lb./sq. ft.

$$\text{Required thrust-block area} = \frac{W}{F} = \frac{30{,}200}{1500}$$

20.2 sq. ft.

2nd Example:

Thrust-block for elbow 12" dia. 90°
Test pressure: 250 P.S.I.
Soil: Clay and marl
Thrust (Table V) W = 37,800 x 1.41 = 53,300 P.S.I.
Soil bearing power (Table VI) F = 2000 lbs.

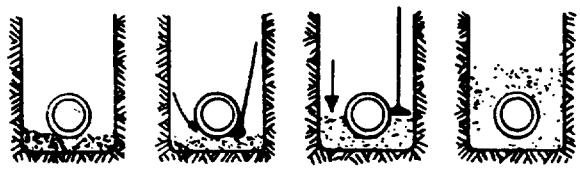
$$\text{Required thrust-block area} = \frac{W}{F} = \frac{53{,}300}{2000}$$

26.65 sq. ft.

G BACKFILLING AND TAMPING

Initial backfilling should be done as soon as possible after the pipe has been placed to protect the pipe from falling rocks, flooding and cave-ins. Provide a continuous bed by placing selected material under pipe and coupling and between the pipeline and the trench walls (Figure 17).

FIGURE 17



1. Place soil in 4" layers
2. Tamp under pipe at both sides
3. Add another 4" layer and tamp until half way up the pipe
4. Backfill by hand 12" over the pipe

Couplings are normally exposed until the line has been tested; initial backfill should proceed until the pipe has been covered by at least 12" of well selected material.
Water tamping may be used where drainage is good.

H TESTING

Pressure tests are generally carried out at an internal pressure of 50 P.S.I. above the actual operating pressure. Individual test sections should preferably not exceed 1000 ft. in length. Couplings should be uncovered for the test so that possible leaks are readily located. Before pressure testing, all parts of the pipeline have to be backfilled to prevent movement. All thrust-blocks should be in place and completely hardened. To insure that pipeline section is

CAPCO KIN 0000260

well vented, it should be filled at the lowest point of the line and an adequate venting port should be provided at the other end.

Dry cement-asbestos pipe is hydroscopic so that lines must be filled at least 24 hours prior to testing. Prior to final testing, again make sure that all entrapped air has been removed. All valves and hydrants must be closed. The pressure test is built up by using a hand pump or a small power pump. The quantity of water measured to maintain the test pressure is usually specified by the engineer.

TABLE VII

Allowable Leakage per 100 Couplings

Pipe Diameter in.	Test Pressure at Lowest Point in Line—psi						
	50	75	100	125	150	200	225
	Leakage—gph						
4	0.71	0.87	1.00	1.02	1.23	1.42	1.51
6	1.06	1.29	1.51	1.68	1.84	2.12	2.25
8	1.42	1.72	2.00	2.24	2.45	2.84	3.00
10	1.77	2.15	2.50	2.79	3.07	3.54	3.75
12	2.12	2.58	3.00	3.35	3.68	4.24	4.52
14	2.48	3.01	3.50	3.91	4.28	4.96	5.26
16	2.83	3.44	4.01	4.47	4.89	5.68	6.00

Table I from AWWA C603-64T

I HOW TO REPAIR DAMAGED PIPE

A bolted repair clamp may be used to repair bruises or cracks in the pipe wall. If the pipe has been broken cleanly into two pieces, the ends can either be joined together with a repair clamp or replaced.

If the coupling area of the pipe has been chipped or cracked more than ½'' from the end, the damaged area has to be cut off at least 1'' beyond the defect and the pipe end has to be remachined.

Scratches not over 1/16'' deep and ½'' wide can be sanded smooth so that the rubber rings will seat properly on the pipe. Deeper scratches or gouges will prevent the ring from sealing properly.

Therefore, the entire area should be cut off and the pipe end remachined.

If an undamaged pipe section must be replaced with insertion of fittings, couplings should be cut carefully to prevent damage to the machined section of pipe. Use hack saw, carpenter saw or cold chisel and hold tool parallel to pipe (see Figure 18).

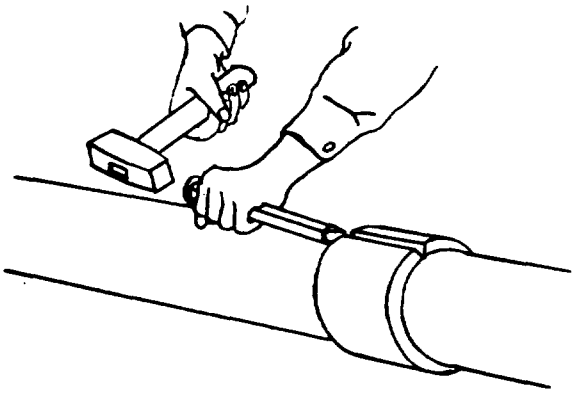


FIGURE 18

CAPCO KIN 0000261

MATERIAL SPECIFICATION

PERMAFLEX* ASBESTOS-CEMENT WATER PIPE

SECTION 1—SCOPE:

1.1 General: This specification designates the requirements for Permaflex* asbestos-cement water pipe manufactured for use in supply lines and distribution systems which carry water under pressure. This specification also designates the requirements for Permaflex asbestos-cement water pipe for use in sewer force mains which carry sewage under pressure.

SECTION 2—GENERAL REQUIREMENTS:

2.1 Sizes: Permaflex water pipe shall be manufactured with nominal inside diameters of 3, 4, 6, 8, 10, 12, 14, and 16 inches.

2.2 Classes: Permaflex water pipe shall be manufactured for use in service at maximum operating pressures of 100, 150, or 200 pounds per square inch. Pipe shall be designated as Class 100, 150, and 200, respectively, for the above maximum operating pressures.

2.3 Lengths:

2.31 Standard Lengths: The standard nominal length for Permaflex water pipe shall be 13 feet. A maximum of 10 percent of the total footage of any one size and class for any one order may be furnished, at the manufacturer's option, in pipe lengths shorter than 13 feet but not less than 7 feet. These shorter lengths shall be termed random lengths.

2.32 Short Lengths: Short lengths furnished for use in making rigid connections to fittings or structures shall not exceed 6 feet 6 inches.

*Reg. U.S. Pat. Off.

2.4 Couplings:

One Permaflex coupling shall be furnished with each standard, random and short length of pipe. It shall consist of an asbestos-cement sleeve and two solid rubber rings of uniform cross section and shall be suitable in size and design for the pipe with which it is used.

2.5 Materials:

2.51 Pipe and Permaflex Coupling: Permaflex water pipe and Permaflex coupling shall be composed of an intimate mixture of portland cement, silica and asbestos fiber and shall be free from organic substances.

2.52 Permaflex Coupling Rubber Rings: The rubber-ring gaskets shall consist of a vulcanized rubber compound.

SECTION 3—DETAIL REQUIREMENTS:

3.1 Pipe:

3.11 Description: Permaflex water pipe shall conform to the dimensions and tolerances given in Table I following. Each pipe shall be properly machined on each end so as to facilitate joining the pipe sections without damage and to provide end separation of pipes in each coupling assembly. The pipe ends shall also be compatible with the coupling so as to provide confinement of the rubber rings.

CAPCO KIN 0000262

TABLE I

DIMENSIONS OF PIPE AND COUPLING IN INCHES

Nom. Pipe Size	Class 100						
	D	D 2	D 3	D 5	D 6	D 8	D* 9
3	3.00	3.74	3.90	4.03	4.48	3.86	3.94
4	4.00	4.64	4.80	4.93	5.38	4.76	4.84
6	6.00	6.91	7.07	7.20	7.65	7.03	7.13
8	8.00	9.11	9.27	9.40	9.85	9.23	9.33
10	9.85	10.89	11.05	11.18	11.63	11.01	11.25
12	11.70	12.99	13.15	13.28	13.73	13.11	13.32
14	13.59	15.07	15.23	15.39	15.95	15.20	15.33
16	15.50	17.15	17.31	17.47	18.03	17.28	17.45

Nom. Pipe Size	Class 150						
	D	D 2	D 3	D 5	D 6	D 8	D* 9
3	3.00	3.84	4.00	4.13	4.58	3.96	4.10
4	4.00	4.81	4.97	5.10	5.55	4.93	5.01
6	5.85	6.91	7.07	7.20	7.65	7.03	7.13
8	7.85	9.11	9.27	9.40	9.85	9.23	9.33
10	10.00	11.66	11.82	11.95	12.40	11.78	11.88
12	12.00	13.92	14.08	14.21	14.66	14.04	14.14
14	14.00	16.22	16.38	16.54	17.10	16.35	16.48
16	16.00	18.46	18.62	18.78	19.34	18.59	18.72

*Subject to manufacturer's tolerances.

NOTE: See page 34 for key to dimensions.

Nom. Pipe Size	Class 200						
	D	D 2	D 3	D 5	D 6	D 8	D* 9
3	3.00	3.84	4.00	4.13	4.58	3.96	4.17
4	4.00	4.81	4.97	5.10	5.55	4.93	5.32
6	5.70	6.91	7.07	7.20	7.65	7.03	7.21
8	7.60	9.11	9.27	9.40	9.85	9.23	9.39
10	9.63	11.66	11.82	11.95	12.40	11.78	11.86
12	11.56	13.92	14.08	14.21	14.66	14.04	14.12
14	13.59	16.22	16.38	16.54	17.10	16.35	16.42
16	15.50	18.46	18.62	18.78	19.34	18.59	18.69

*Subject to manufacturer's tolerances.

Tolerances on Machined Portion of Pipe and Coupling in Inches

Pipe OD	
D2	D3
3"-12": + .03-.03 14"-16": + .04-.04	
Coupling ID	
D6	D8
3"-12", + .03-.03 14"-16", + .04-.04	
Length Tolerances	
Std: + .0, -1.0 Short Lgths: ± ⅜	

CAPCO KIN 0000263

3.12 Hydrostatic Strength: Each standard, random and short length of Permaflex water pipe shall be designed to have sufficient strength to withstand an internal hydrostatic pressure listed under Table II when applied as specified in Section 4.22.

TABLE II

A

Routine Hydrostatic Pressure, psi

Class	Test Pressure
100	350
150	525
200	700

B

Sampling Hydrostatic Test Pressure, psi

Class	Test Pressure
100	400
150	600
200	800

3.13 Flexural Strength: Each standard length of Permaflex water pipe in sizes 4, 6, and 8 inches shall have sufficient flexural strength to withstand, without failure, the total loads listed in Table III when applied at the third points of a 12-foot span for 13-foot lengths in the manner specified in Section 4.23.

TABLE III

Flexural Test Loads

Nominal Diameter In.	Class 100	Class 150	Class 200
	Total Applied Load—Lb.		
4	900	1,095	1,395
6	2,100	2,775	3,675
8	3,998	5,700	7,598

3.14 Crushing Strength: Permaflex water pipe shall have the crushing strength indicated in Table IV when tested in accordance with ASTM 3-Edge Bearing Method as specified in Section 4.24.

TABLE IV

Crushing Test Loads

Nominal Diameter In.	Class 100	Class 150	Class 200
	Applied Load per Foot of Length—Lb.		
3	4,600	6,700	8,800
4	4,100	5,400	8,700
6	4,000	5,400	9,000
8	4,000	5,500	9,300
10	4,400	7,000	11,000
12	5,200	7,600	11,800
14	5,200	8,600	13,500
16	5,800	9,200	15,400

3.2 Permaflex Coupling Sleeves:

3.21 Description: Permaflex coupling sleeves shall conform to the dimensions and tolerances listed in Table I. The inner surface of each sleeve shall be

CAPCO KIN 0000264

machined with gasket retaining grooves, so that when the joint is assembled the gasket shall be compressed to form a water-tight seal.

3.22 Hydrostatic Strength: Each Permaflex coupling sleeve shall be designed to have sufficient strength to withstand the internal hydrostatic pressures listed in Table II when applied as specified in Section 4.32.

3.3 Rubber Rings:
Rubber ring gaskets shall conform to the manufacturer's standards.

3.4 Chemical Requirements:
The uncombined calcium hydroxide present in Permaflex water pipe and Permaflex coupling sleeves shall not be more than 1%. When requested on the order, this test shall be conducted in accordance with the method described in Section 4.5.

SECTION 4—INSPECTION, TESTS AND REJECTIONS:

4.1 General: All material furnished under this specification shall be inspected and tested in a normal air-dry condition prior to shipment for conformance to the requirements stated in previous sections. When required on his order, the purchaser may witness inspection and test procedures at his own expense. In lieu of this, he may request the manufacturer to submit a certificate certifying the product meets the requirements of this specification.

4.2 Pipe:
4.21 Inspection: Before shipment, each pipe shall be inspected by the manufacturer for conformance to the dimensions and tolerances specified in Section 3.11.

4.22 Hydrostatic Test: Before shipment, each standard, random and short length of pipe in each size and class shall be tested hydrostatically to the routine test pressures specified in Table II-A by the manufacturer.
In addition, from each lot of 300 standard lengths of a given size and class which have passed the routine test, the manufacturer shall select one section at random and test it to the sampling hydrostatic requirements listed in Table II-B and subsequently retest it to the pressure specified in Table II-A. If any pipe fails to withstand this sampling test, five additional lengths shall be selected and tested. Failure of two of these additional lengths to meet the specified requirements will necessitate rejection of the entire lot of pipe represented.
The test listed in Table II shall be conducted by placing the pipe in a hydrostatic testing machine which seals the pipe ends. All air shall be expelled and the internal pressure increased at a uniform rate of not less than 100 psi per second to the test pressures specified in Table II. The test pressures specified in Table II shall be maintained for a period of 5 seconds.

4.23 Flexural Test: Before shipment, each 13' standard length of pipe in sizes 4, 6, and 8 inches shall be tested in flexure by the manufacturer for compliance with the flexure strength requirements specified in Section 3.13. The length of pipe shall be supported on a standard flexure testing machine with supports 12-feet apart for the 13-foot lengths. The total load shall be divided equally and applied at third points of the clear span at a minimum rate of at least 500 pounds per second and shall be maintained for 5 seconds.
Each pipe so tested shall support the applicable load without evidence of cracks or other defects.

4.24 Crushing Test: Before shipment, crushing tests shall be conducted by the manufacturer when requested by the purchaser on his order. One specimen length of pipe shall be selected from each lot of 300 lengths of each size and class of pipe or fraction thereof. From the specimen pipe there shall be cut one unmachined section of pipe one-foot long. This section shall be tested in crushing by the ASTM 3-Edge Bearing Method and shall not fail until the total applied load exceeds the tabular value

CAPCO KIN 0000265

given in Table IV for the size and class of pipe being tested. After 75 percent of the specified load is reached, the load shall be applied at a uniform rate of approximately 2000 pounds per minute.

If any specimen tested for crushing strength is less than 100 percent of the crushing load required in Section 3.14, one specimen cut from each of two additional pipe sections of the same lot shall be subjected to the crushing test.

The failure of one of these additional specimens to meet the crushing strength requirements of Section 3.14 shall be cause for rejection of the entire lot of pipe represented.

4.3 Permaflex Coupling Sleeves:

4.31 Inspection: Before shipment, each Permaflex coupling sleeve shall be inspected by the manufacturer for conformance with the dimensions and tolerances specified in Section 3.21.

4.32 Hydrostatic Test: Before shipment, each Permaflex coupling sleeve shall be tested hydrostatically by the manufacturer to the routine Hydrostatic Test pressures specified in Section 3.22 and Table II-A. In addition, from each lot of 300 couplings of a given size and class which have passed the routine test, the manufacturer shall select one at random and test it to the sampling hydrostatic requirement specified in Section 3.22 and Table II-B and subsequently retest it to the pressures specified in Table II-A. If any coupling fails to withstand this sampling test, five additional couplings shall be selected and tested. Failure of two of these additional couplings to meet the specified requirement will necessitate rejection of the entire lot of couplings represented. The tests listed in Table II shall be conducted by placing the coupling in a hydrostatic testing device designed to subject the coupling to internal bursting pressure. The pressure shall be increased at a steady rate of at least 100 psi per second to the test pressure specified in Table II and held at the test pressure for 5 seconds.

4.4 Permaflex Coupling Rubber Rings:

4.41 Inspection: Rubber ring gaskets shall be inspected by the manufacturer, before shipment, for compliance with the manufacturer's standards.

4.5 Uncombined Calcium Hydroxide Test:

Before shipment, when requested on the order, the Uncombined Calcium Hydroxide Test shall be conducted on one representative sample by the method described in this section.

4.51 Reagents:

A. Phenolphthalein Indicator—Dissolve 1 g of phenolphthalein in 100 ml of absolute ethanol.

B. Glycerol — Ethanol Solvent — Prepare a solution consisting of glycerol: anhydrous or absolute ethanol—1:2 by volume (commercial solvents consisting of 95% absolute ethanol and 5% isopropanol may be substituted). To each liter of this mixture 2 ml of the indicator is added. Adjust the solvent to slightly basic with either dilute NaOH in absolute ethanol or standard ammonium acetate, depending on the original pH.

C. Standard Ammonium Acetate Solution (1 ml= 0.005 g CaO) Dissolve 16g dry crystalline ammonium acetate in one liter of absolute or anhydrous ethanol. The solution is standardized against known amount of pure CaO by titrating a mixture of 0.05-0.06 g ground CaO, 60 nl of the glycerol-ethanol solvent, and 2 g of anhydrous strontium nitrate $Sr(NO_3)_2$ to a colorless end point. When the solution is boiled for 10 minutes, no color should appear. If color appears, continue titration.

4.52 Procedure: Representative samples of pipe or sleeve shall be prepared and immediately screened through a 20 mesh screen. Place the material passing through the screen immediately into a weighing bottle and cover with its ground glass top.

Place the bottle with top removed into a drying oven at 105° C for 2 hours and then cool in a desiccator to room temperature.

CAPCO KIN 0000266

Weigh out 1 g ± 0.010 g of the prepared sample to the nearest 0.001 g, and place it into a dry 250 Erlenmeyer flask, to which a teflon encapsulated stirring bar, 60 ml of the glycerol-ethanol reagent and 2 g of $Sr(NO_3)_2$ are added. Attach flask to a water-cooled condenser (with standard 24/40 glass joint) and place on hot plate-magnetic stirrer. Boil the solution gently for 30 minutes with mild stirring, then remove the flask and filter the mixture on a Buchner funnel under vacuum. Bring filtrate to a boil and titrate with standardized ammonium acetate to the end point. The end point is observed by comparison with a similar mixture containing no phenolphthalein indicator. No excess ammonium acetate should be added at any time, because an excess may react with calcium silicates and aluminates.

4.53 Calculation:

A. Standardization of Ammonium Acetate Solution

$$E = \frac{W_{CaO}}{Va} \times 1.32$$

where E = weight of $Ca(OH)_2$ in g/ml of Ammonium Acetate solution

W_{CaO} = weight of CaO in grams

Va = volume of Ammonium Acetate in ml

B. Percentage of Uncombined $Ca(OH)_2$, in % = $\frac{EV}{W} \times 100$

where V = Volume of Ammonium Acetate solution required by sample in ml

W = Weight of sample in grams to nearest 0.001.

SECTION 5—MARKING:

5.1 Pipe: Each standard length and each random and short length of pipe shall be marked with the manufacturer's name, trade name "Permaflex," nominal size, class, hydrostatic test pressure, a "T" to signify it was tested, and date of manufacture.

5.2 Coupling Sleeves: Each Permaflex coupling shall be marked by the manufacturer with the manufacturer's identification, the size, the class of pipe with which it shall be used, and with a "T" to signify it has been hydrostatically tested.

5.3 Rubber Rings: Each Permaflex rubber ring shall be marked with the manufacturer's identification, the size, the year of manufacture, and the classes of pipe with which it can be used.

SECTION 6—PREPARATION FOR SHIPMENT:

6.1 General:

Permaflex water pipe and couplings shall be prepared for standard commercial shipment so as to assure acceptance by common or other carriers.

SECTION 7—SUPPLEMENTARY DETAILS TO BE SPECIFIED BY PURCHASER:

7.1 General: When purchasing Permaflex water pipe under these specifications, the purchaser shall supplement them with the following specific requirements for each lot of pipe.

7.2 Laying Length: The purchaser shall state the total laying length of each size and class of pipe required.

7.21 Short Lengths: The purchaser shall state the total footage of short lengths which shall be required for making rigid connections to fittings and structures and for making closures as described in Section 2.32.

7.3 Coating of Pipe and Couplings: When the purchaser requires that the interior surface of the pipe and couplings be coated with a bituminous seal coating, he shall so state on his order.

7.4 Inspection and Tests: When the purchaser wishes to witness the inspection and tests conducted by the manufacturer, he shall so state on his order so that the manufacturer can notify the purchaser in ample time. All expense incidental to this inspection shall be assumed by the purchaser.

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7.41 Certificate of Test: When the purchaser requires a certificate of test in lieu of witnessing the inspection and test procedures, he shall so state on his order.

7.42 Crushing Tests: When the purchaser requires that the crushing tests be conducted on pipe, he shall so state on his order.

7.43 Uncombined Calcium Hydroxide Tests: When the purchaser requires that the Uncombined Calcium Hydroxide Tests be conducted, he shall so state on his order.

TABLE OF DIMENSIONS

CLASS 100

ALL CLASSES

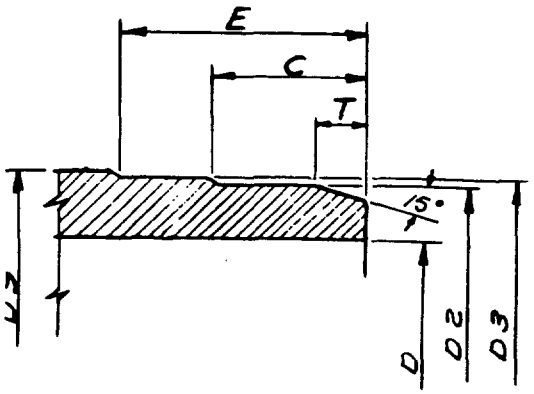
PIPE SIZE	D	D2 D4	D3	D5	D6	D7	D8	D9	N	Q	C	E	T
3	3.00	3.74	3.90	4.03	4.48	5.38	3.86	3.94	6.25	1.00	1.87	3.37	.62
4	4.00	4.64	4.80	4.93	5.38	6.20	4.76	4.84	6.25	1.00	1.87	3.37	.62
6	6.00	6.91	7.07	7.20	7.65	8.26	7.03	7.13	6.25	1.00	1.87	3.37	.62
8	8.00	9.11	9.27	9.40	9.85	10.46	9.23	9.33	7.00	1.00	2.25	3.75	.75
10	9.85	10.89	11.05	11.18	11.63	13.02	11.01	11.25	7.00	1.00	2.25	3.75	.75
12	11.70	12.99	13.15	13.28	13.73	15.28	13.11	13.32	7.00	1.00	2.25	3.75	.75
14	13.59	15.07	15.23	15.39	15.95	17.49	15.20	15.33	8.00	1.06	2.62	4.25	1.00
16	15.50	17.15	17.31	17.47	18.03	19.74	17.28	17.45	8.00	1.06	2.62	4.25	1.00

CLASS 150

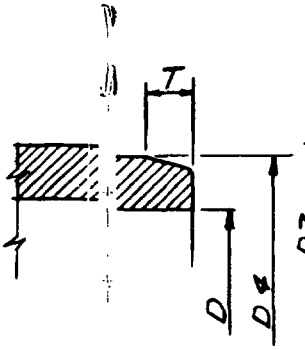
PIPE SIZE	D	D2 D4	D3	D5	D6	D7	D8	D9	LENGTH OF PIPE
3	3.00	3.84	4.00	4.13	4.58	5.58	3.96	4.10	STANDARD: 13'-0"
4	4.00	4.81	4.97	5.10	5.55	6.50	4.93	5.01	HALF LENGTHS: 6'-6"
6	5.85	6.91	7.07	7.20	7.65	8.90	7.03	7.13	QUARTER LENGTHS: 3'-3"
8	7.85	9.11	9.27	9.40	9.85	11.25	9.23	9.33	STANDARD LENGTHS MEE
10	10.00	11.66	11.82	11.95	12.40	14.30	11.78	11.88	HALF LENGTHS MEE
12	12.00	13.92	14.08	14.21	14.66	16.75	14.04	14.14	QUARTER LENGTHS MOA
14	14.00	16.22	16.38	16.54	17.10	19.50	16.35	16.48	GASKETS ARE MARKED FOR—
16	16.00	18.46	18.62	18.78	19.34	22.00	18.59	18.72	SIZES & CLASSES

CAPCO KIN 0000268

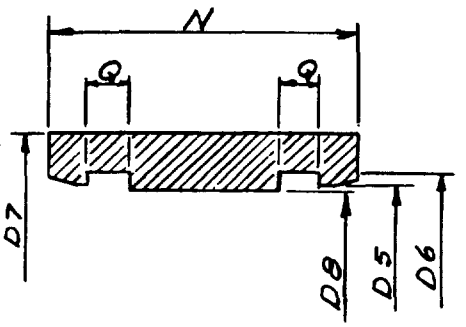
PIPE SIZE	D	D2 D4	D3	D5	D6	D7	D8	D9	TOLERANCES
3	3.00	3.84	4.00	4.13	4.58	5.58	3.96	4.17	DIMS. D_2, D_3, D_4, D_5, D_6, & D_8
4	4.00	4.81	4.97	5.10	5.55	6.71	4.93	5.32	3"–12" +.03 –.03
6	5.70	6.91	7.07	7.20	7.65	9.01	7.03	7.21	14"–16" +.04 –.04
8	7.60	9.11	9.27	9.40	9.85	11.41	9.23	9.39	DIMS. D_7, D_9 & N
10	9.63	11.66	11.82	11.95	12.40	14.40	11.78	11.86	SUBJECT TO MFGR. TOLERANCE
12	11.56	13.92	14.08	14.21	14.66	16.94	14.04	14.12	ANGLE ± 2°
14	13.59	16.22	16.38	16.54	17.10	19.84	16.35	16.42	LENGTH OF PIPE +.00 –1.0
16	15.50	18.46	18.62	18.78	19.34	22.41	18.59	18.69	SHORT PIECES +.00 –0.375



STANDARD LENGTH



SHORT LENGTH



PERMAFLEX COUPLING

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NOTES

FLOW OF WATER IN PERMAFLEX PIPE

CAPCO KIN 0000271

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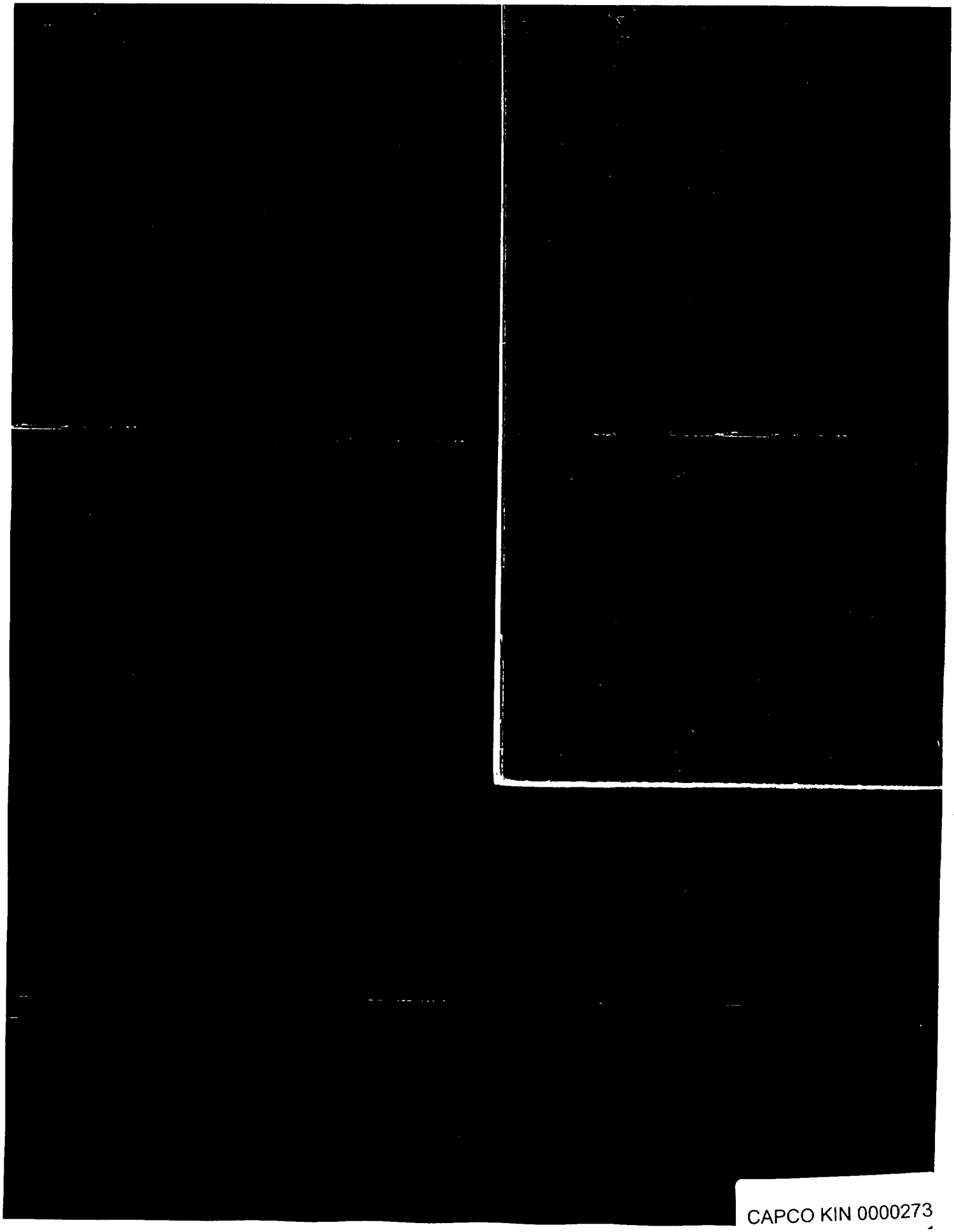

PERMAFLEX WATER PIPE MATERIAL SPECIFICATION CA101 65

CA

CEMENT ASBESTOS PRODUCTS COMPANY

CAPCO KIN 0000274

TABLE OF CONTENTS

1. SCOPE

2. GENERAL REQUIREMENTS

3. DETAIL REQUIREMENTS

4. INSPECTION, TESTS AND REJECTIONS

5. MARKING

6. PREPARATION FOR SHIPMENT

7. SUPPLEMENTARY DETAILS TO BE SPECIFIED BY PURCHASER

Permaflex asbestos-cement water pipe manufactured to this specification meets or exceeds the requirements of the following specifications:

AWWA C400-64T
ASTM C296-63T
Federal Specifications SS-P-351a

MATERIAL SPECIFICATION

PERMAFLEX*ASBESTOS-CEMENT WATER PIPE

SECTION 1 — SCOPE:

1.1 **General:** This specification designates the requirements for Permaflex* asbestos-cement water pipe manufactured for use in supply lines and distribution systems which carry water under pressure. This specification also designates the requirements for Permaflex asbestos-cement water pipe for use in sewer force mains which carry sewage under pressure.

SECTION 2 — GENERAL REQUIREMENTS:

2.1 **Sizes:** Permaflex water pipe shall be manufactured with nominal inside diameters of 3, 4, 6, 8, 10, 12, 14, and 16 inches.

2.2 **Classes:** Permaflex water pipe shall be manufactured for use in service at maximum operating pressures of 100, 150, or 200 pounds per square inch. Pipe shall be designated as Class 100, 150, and 200, respectively, for the above maximum operating pressures.

2.3 **Lengths:**

2.31 **Standard Lengths:** The standard nominal length for Permaflex Water Pipe shall be 13 feet.

A maximum of 10 percent of the total footage of any one size and class for any one order may be furnished, at the manufacturer's option, in pipe lengths shorter than 13 feet but not less than 7 feet.

These shorter lengths shall be termed random lengths.

2.32 **Short Lengths:** Short lengths furnished for use in making rigid connections to fittings or structures shall not exceed 6 feet 6 inches.

2.4 **Couplings:**

One Permaflex* Coupling shall be furnished with each standard, random and short length of pipe. It shall consist of an asbestos-cement sleeve and two solid rubber rings of uniform cross section and shall be suitable in size and design for the pipe with which it is used.

2.5 **Materials:**

2.51 **Pipe and Permaflex Coupling:** Permaflex water pipe and Permaflex coupling shall be composed of an intimate mixture of portland cement, silica and asbestos fiber and shall be free from organic substances.

2.52 **Permaflex Coupling Rubber Rings:** The rubber-ring gaskets shall consist of a vulcanized rubber compound.

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SECTION 3 — DETAIL REQUIREMENTS:

3.1 Pipe:

3.11 **Description:** Permaflex water pipe shall conform to the dimensions and tolerances given in Table I following. Each pipe shall be properly machined on each end so as to facilitate joining the pipe sections without damage and to provide end separation of pipes in each coupling assembly. The pipe ends shall also be compatible with the coupling so as to provide confinement of the rubber rings.

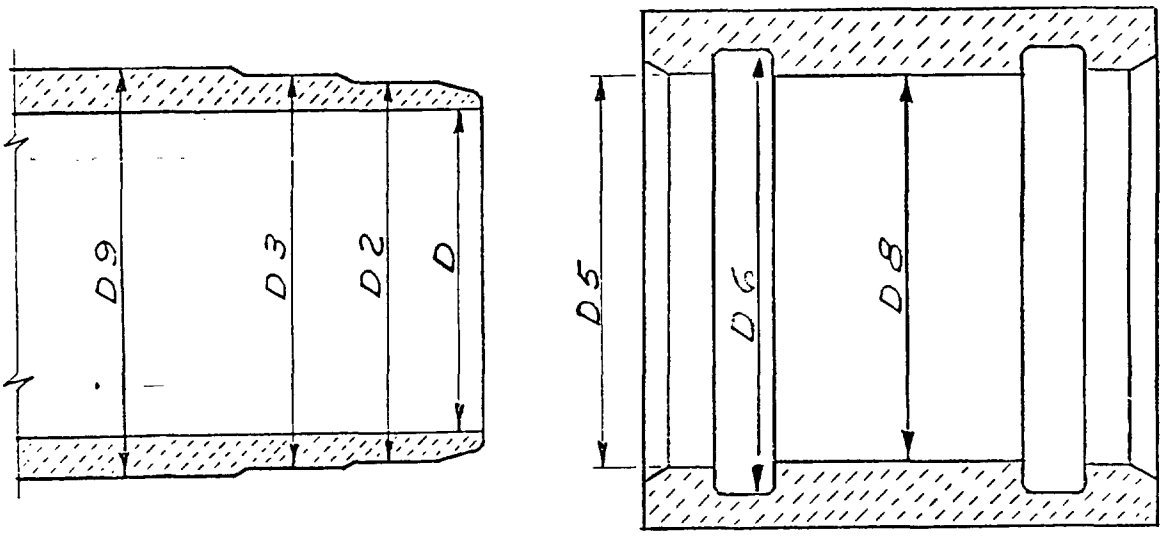

TABLE I

DIMENSIONS OF PIPE AND COUPLING IN INCHES

Nom. Pipe Size	Class 100						
	D	D 2	D 3	D 5	D 6	D 8	D * 9
3	3.00	3.74	3.90	4.03	4.48	3.86	3.94
4	4.00	4.64	4.80	4.93	5.38	4.76	4.84
6	6.00	6.91	7.07	7.20	7.65	7.03	7.13
8	8.00	9.11	9.27	9.40	9.85	9.23	9.33
10	9.85	10.89	11.05	11.18	11.63	11.01	11.25
12	11.70	12.99	13.15	13.28	13.73	13.11	13.32
14	13.59	15.07	15.23	15.39	15.95	15.20	15.33
16	15.50	17.15	17.31	17.47	18.03	17.28	17.45

*Subject to manufacturer's tolerances.

CAPCO KIN 0000277

SECTION 3 — DETAIL REQUIREMENTS: (Continued)

Nom. Pipe Size	Class 150						
	D	D_2	D_3	D_5	D_6	D_8	D_9 *
3	3.00	3.84	4.00	4.13	4.58	3.96	4.10
4	4.00	4.81	4.97	5.10	5.55	4.93	5.01
6	5.85	6.91	7.07	7.20	7.65	7.03	7.13
8	7.85	9.11	9.27	9.40	9.85	9.23	9.33
10	10.00	11.66	11.82	11.95	12.40	11.78	11.88
12	12.00	13.92	14.08	14.21	14.66	14.04	14.14
14	14.00	16.22	16.38	16.54	17.10	16.35	16.98
16	16.00	18.46	18.62	18.78	19.34	18.59	18.72

Nom. Pipe Size	Class 200						
	D	D_2	D_3	D_5	D_6	D_8	D_9 *
3	3.00	3.84	4.00	4.13	4.58	3.96	4.17
4	4.00	4.81	4.97	5.10	5.55	4.93	5.32
6	5.70	6.91	7.07	7.20	7.65	7.03	7.21
8	7.60	9.11	9.27	9.40	9.85	9.23	9.39
10	9.63	11.66	11.82	11.95	12.40	11.78	11.86
12	11.56	13.92	14.08	14.21	14.66	14.04	14.12
14	13.59	16.22	16.38	16.54	17.10	16.35	16.42
16	15.50	18.46	18.62	18.78	19.34	18.59	18.69

Tolerances on Machined Portion of Pipe and Coupling in Inches

Pipe OD	Coupling ID	Length Tolerances
D_2, D_3	D_6, D_8	
4"-12": +.04-.03	4"-10", +.04-.02	Std: + .0, -1.0
14"-16": +.04-.04	12"-16", +.04-.03	Short Lgths: ±⅜

*Subject to manufacturer's tolerances.

SECTION 3 — DETAIL REQUIREMENTS: (Continued)

3.1 Pipe: (Continued)

3.12 Hydrostatic Strength: Each standard, random and short length of Permaflex water pipe shall be designed to have sufficient strength to withstand an internal hydrostatic pressure listed under Table II when applied as specified in Section 4:22.

TABLE II

A		B	
Routine Hydrostatic Pressure, psi		Sampling Hydrostatic Test Pressure, psi	
Class	Test Pressure	Class	Test Pressure
100	350	100	400
150	525	150	600
200	700	200	800

3.13 Flexural Strength: Each standard length of Permaflex water pipe in sizes 4, 6, and 8 inches shall have sufficient flexural strength to withstand, without failure, the total loads listed in Table III when applied at the third points of a 12-foot span for 13-foot lengths in the manner specified in Section 4.23.

TABLE III

Flexural Test Loads

Nominal Diameter In.	Class 100	Class 150	Class 200
	Total Applied Load — Lb.		
4	1,200	1,460	1,860
6	2,800	3,700	4,900
8	5,330	7,600	10,130

3.14 Crushing Strength: Permaflex water pipe shall have the crushing strength indicated in Table IV when tested in accordance with ASTM 3-Edge Bearing Method as specified in Section 4.24.

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SECTION 3 — DETAIL REQUIREMENTS: (Continued)

TABLE IV

Crushing Test Loads

Nominal Diameter In.	Class 100	Class 150	Class 200
	Applied Load per Foot of Length — Lb.		
3	4,600	6,700	8,800
4	4,100	5,400	8,700
6	4,000	5,400	9,000
8	4,000	5,500	9,300
10	4,400	7,000	11,000
12	5,200	7,600	11,800
14	5,200	8,600	13,500
16	5,800	9,200	15,400

3.2 **Permaflex Coupling Sleeves:**

3.21 **Description:** Permaflex coupling sleeves shall conform to the dimensions and tolerances listed in Table I. The inner surface of each sleeve shall be machined with gasket retaining grooves. so that when the joint is assembled the gasket shall be compressed to form a water-tight seal.

3.22 **Hydrostatic Strength:** Each Permaflex coupling sleeve shall be designed to have sufficient strength to withstand the internal hydrostatic pressures listed in Table II when applied as specified in Section 4.32.

3.3 **Rubber Rings:**

Rubber ring gaskets shall conform to the manufacturer's standards.

3.4 **Chemical Requirements:**

The uncombined calcium hydroxide present in Permaflex water pipe and Permaflex coupling sleeves shall not be more than 1%. When requested on the order. this test shall be conducted in accordance with the method described in Section 4.5.

SECTION 4 — INSPECTION, TESTS AND REJECTIONS:

4.1 **General:** All material furnished under this specification shall be inspected and tested in a normal air-dry condition prior to shipment for conformance to the requirements stated in previous sections. When required on his order, the purchaser may witness inspection and test procedures at his own expense. In lieu of this, he may request the manufacturer to submit a certificate certifying the product meets the requirements of this specification.

SECTION 4 — INSPECTION, TESTS AND REJECTIONS: (Continued)

4.2 Pipe:

4.21 Inspection: Before shipment, each pipe shall be inspected by the manufacturer for conformance to the dimensions and tolerances specified in Section 3.11.

4.22 Hydrostatic Test: Before shipment, each standard, random and short length of pipe in each size and class shall be tested hydrostatically to the routine test pressures specified in Table II-A by the manufacturer.

In addition, from each lot of 300 standard lengths of a given size and class which have passed the routine test, the manufacturer shall select one section at random and test it to the sampling hydrostatic requirements listed in Table II-B and subsequently retest it to the pressure specified in Table II-A. If any pipe fails to withstand this sampling test, five additional lengths shall be selected and tested. Failure of two of these additional lengths to meet the specified requirements will necessitate rejection of the entire lot of pipe represented.

The tests listed in Table II shall be conducted by placing the pipe in a hydrostatic testing machine which seals the pipe ends. All air shall be expelled and the internal pressure increased at a uniform rate of not less than 100 psi per second to the test pressures specified in Table II. The test pressures specified in Table II shall be maintained for a period of 5 seconds.

4.23 Flexural Test: Before shipment, each 13' standard length of pipe in sizes 4, 6, and 8 inches shall be tested in flexure by the manufacturer for compliance with the flexure strength requirements specified in Section 3.13. The length of pipe shall be supported on a standard flexure testing machine with supports 12-feet apart for the 13-foot lengths. The total load shall be divided equally and applied at third points of the clear span at a minimum rate of at least 500 pounds per second and shall be maintained for 5 seconds.

Each pipe so tested shall support the applicable load without evidence of cracks or other defects.

4.24 Crushing Test: Before shipment, crushing tests shall be conducted by the manufacturer when requested by the purchaser on his order. One specimen length of pipe shall be selected from each lot of 300 lengths of each size and class of pipe or fraction thereof. From the specimen pipe there shall be cut one unmachined section of pipe one-foot long. This section shall be tested in crushing by the ASTM 3-Edge Bearing Method and shall not fail until the total applied load exceeds the tabular value given in Table IV for the size and class of pipe being tested. After 75 percent of the specified load is reached, the load shall be applied at a uniform rate of approximately 2000 pounds per minute.

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SECTION 4 — INSPECTION, TESTS AND REJECTIONS: (Continued)

If any specimen tested for crushing strength is less than 100 percent of the crushing load required in Section 3.14, one specimen cut from each of two additional pipe sections of the same lot shall be subjected to the crushing test.

The failure of one of these additional specimens to meet the crushing strength requirements of Section 3.14 shall be cause for rejection of the entire lot of pipe represented.

4.3 **Permaflex Coupling Sleeves:**

4.31 **Inspection:** Before shipment, each Permaflex coupling sleeve shall be inspected by the manufacturer for conformance with the dimensions and tolerances specified in Section 3.21.

4.32 **Hydrostatic Test:** Before shipment, each Permaflex coupling sleeve shall be tested hydrostatically by the manufacturer to the routine Hydrostatic Test pressures specified in Section 3.22 and Table II-A. In addition, from each lot of 300 couplings of a given size and class which have passed the routine test, the manufacturer shall select one at random and test it to the sampling hydrostatic requirement specified in Section 3.22 and Table II-B and subsequently retest it to the pressures specified in Table II-A. If any coupling fails to withstand this sampling test, five additional couplings shall be selected and tested. Failure of two of these additional couplings to meet the specified requirement will necessitate rejection of the entire lot of couplings represented.

The tests listed in Table II shall be conducted by placing the coupling in a hydrostatic testing device designed to subject the coupling to internal bursting pressure. The pressure shall be increased at a steady rate of at least 100 psi per second to the test pressure specified in Table II and held at the test pressure for 5 seconds.

4.4 **Permaflex Coupling Rubber Rings:**

4.41 **Inspection:** Rubber ring gaskets shall be inspected by the manufacturer, before shipment, for compliance with the manufacturer's standards.

4.5 **Uncombined Calcium Hydroxide Test:**

Before shipment, when requested on the order, the Uncombined Calcium Hydroxide Test shall be conducted on one representative sample by the method described in this section.

4.51 **Reagents:**

A. Phenolphthalein Indicator — Dissolve 1 g of phenolphthalein in 100 ml of absolute ethanol.

B. Glycerol — Ethanol Solvent — Prepare a solution consisting of glycerol: anhydrous or absolute ethanol — 1:2 by volume (commercial solvents consisting of 95% absolute ethanol and 5% isopropanol may be substituted). To each liter of this mixture 2 ml of the indicator is added. Adjust the solvent to slightly basic with either dilute NaOH in absolute ethanol or standard ammonium acetate, depending on the original pH.

C. Standard Ammonium Acetate Solution (1 ml = 0.005 g CaO) Dissolve 16g dry crystalline ammonium acetate in one liter of absolute or anhydrous ethanol. The solution is standardized against known amount of pure CaO by titrating a mixture of 0.05-0.06 g ground CaO, 60 nl of the glycerol-ethanol solvent, and 2 g of anhydrous strontium nitrate $Sr(NO_3)_2$ to a colorless end point. When the solution is boiled for 10 minutes, no color should appear. If color appears, continue titration.

4.52 **Procedure:** Representative samples of pipe or sleeve shall be prepared and immediately screened through a 20 mesh screen. Place the material passing through the screen immediately into a weighing bottle and cover with its ground glass top.

Place the bottle with top removed into a drying oven at 105° C for 2 hours and then cool in a desiccator to room temperature.

Weigh out 1 g $\pm$ 0.010 g of the prepared sample to the nearest 0.001 g, and place it into a dry 250 Erlenmeyer flask, to which a teflon encapsulated stirring bar, 60 ml of the glycerol-ethanol reagent and 2 g of $Sr(NO_3)_2$ are added. Attach flask to a water-cooled condenser (with standard 24/40 glass joint) and place on hot plate-magnetic stirrer. Boil the solution gently for 30 minutes with mild stirring, then remove the flask and filter the mixture on a Buchner funnel under vacuum. Bring filtrate to a boil and titrate with standardized ammonium acetate to the end point. The end point is observed by comparison with a similar mixture containing no phenolphtalein indicator. No excess ammonium acetate should be added at any time, because an excess may react with calcium silicates and aluminates.

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4.53 Calculation:

A. Standardization of Ammonium Acetate Solution

$$E = \frac{W_{CaO}}{Va} \times 1.32$$

where E = weight of $Ca(OH)_2$ in g/ml of ammonium acetate solution

W_{CaO} = weight of CaO in grams

Va = volume of Ammonium Acetate in ml

B. Percentage of Uncombined $Ca(OH)_2$, in % $= \frac{EV}{W} \times 100$

where V = Volume of ammonium acetate solution required by sample in ml

W = Weight of sample in grams to nearest 0.001.

SECTION 5 — MARKING:

5.1 **Pipe:** Each standard length and each random and short length of pipe shall be marked with the manufacturer's name, trade name "Permaflex," nominal size, class. hydrostatic test pressure, a "T" to signify it was tested, and date of manufacture.

5.2 **Coupling Sleeves:** Each Permaflex coupling shall be marked by the manufacturer with the manufacturer's identification, the size, the class of pipe with which it shall be used, and with a "T" to signify it has been hydrostatically tested.

5.3 **Rubber Rings:** Each Permaflex rubber ring shall be marked with the manufacturer's identification, the size, the year of manufacturer, and the classes of pipe with which it can be used.

SECTION 6 — PREPARATION FOR SHIPMENT:

6.1 General:

Permaflex water pipe and couplings shall be prepared for standard commercial shipment so as to assure acceptance by common or other carriers.

SECTION 7 — SUPPLEMENTARY DETAILS TO BE SPECIFIED BY PURCHASER:

7.1 **General:** When purchasing Permaflex water pipe under these specifications, the purchaser shall supplement them with the following specific requirements for each lot of pipe.

7.2 **Laying Length:** The purchaser shall state the total laying length of each size and class of pipe required.

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SECTION 7 — SUPPLEMENTARY DETAILS TO BE SPECIFIED BY PURCHASER: (Continued)

7.21 **Short Lengths:** The purchaser shall state the total footage of short lengths which shall be required for making rigid connections to fittings and structures and for making closures as described in Section 2.32.

7.3 **Coating of Pipe and Couplings:** When the purchaser requires that the interior surface of the pipe and couplings be coated with a bituminous seal coating, he shall so state on his order.

7.4 **Inspection and Tests:** When the purchaser wishes to witness the inspection and tests conducted by the manufacturer, he shall so state on his order so that the manufacturer can notify the purchaser in ample time. All expense incidental to this inspection shall be assumed by the purchaser.

7.41 **Certificate of Test:** When the purchaser requires a certificate of test in lieu of witnessing the inspection and test procedures, he shall so state on his order.

7.42 **Crushing Tests:** When the purchaser requires that the crushing tests be conducted on pipe, he shall so state on his order.

7.43 **Uncombined Calcium Hydroxide Tests:** When the purchaser requires that the Uncombined Calcium Hydroxide Tests be conducted, he shall so state on his order.

CEMENT ASBESTOS PRODUCTS COMPANY

PERMAFLEX®

ASBESTOS-CEMENT

IRRIGATION PIPE

Low Head

MATERIAL SPECIFICATION
CA102 66

CAPCO KIN 0000286

TABLE OF CONTENTS

1. SCOPE

2. GENERAL REQUIREMENTS

3. DETAIL REQUIREMENTS

4. INSPECTION, TESTS AND REJECTIONS

5. MARKING

6. PREPARATION FOR SHIPMENT

7. SUPPLEMENTARY DETAILS TO BE SPECIFIED BY PURCHASER

8. PAGE 3A ADDENDUM, INCLUDING 18, 20 & 24"

MATERIAL SPECIFICATION

PERMAFLEX* ASBESTOS-CEMENT IRRIGATION PIPE

LOW HEAD

SECTION 1 - SCOPE:

1.1 General: This specification covers asbestos-cement low head pipe intended for the conveyance of water under pressure.

SECTION 2 - GENERAL REQUIREMENTS:

2.1 Sizes: Permaflex irrigation pipe shall be manufactured with nominal inside diameters of 4", 6", 8", 10", 12", 14" and 16".

2.2 Types: Permaflex irrigation pipe shall be manufactured in three types described by the maximum feet of head and working pressure.

2.3 Lengths:

2.31 Standard Lengths: The standard nominal length of low head pipe shall be 13 feet in all types and sizes.

A maximum of 10 percent of the total footage of any one size and type for any one order may be furnished, at the manufacturer's option, in pipe length shorter than 13 feet but not less than 7 feet.

2.32 Short Lengths: 3'-3" and 6'-6" sections shall be designated as 1/4 and 1/2 lengths. Five percent of the total footage in each size 4", 6" and 8", and four percent in each size 10", 12", 14" and 16", may be furnished as includes when specified by the purchaser, in 1/4 or 1/2 lengths or any combination of 1/4 and 1/2 lengths. Includes are to be shipped complete with Permaflex couplings.

2.4 Couplings:

One Permaflex* coupling shall be furnished with each standard, random, and short length of pipe. It shall consist of an asbestos-cement sleeve and two solid rubber rings of uniform cross section, and shall be suitable in size and design for the pipe with which it is used.

*Reg. U. S. Pat. Off.

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SECTION 2 - GENERAL REQUIREMENTS: (Continued)

2.5 Materials:

2.51 Pipe and Coupling: Permaflex irrigation pipe and couplings shall be composed of an intimate mixture of Portland cement, asbestos fibre, and silica, and shall be free from organic substances.

2.52 Rubber Gaskets: Rubber gaskets shall consist of a vulcanized rubber compound.

SECTION 3 - DETAIL REQUIREMENTS:

3.1 Pipe:

3.11 Description: Asbestos-Cement Pipe shall be made to the manufacturer's standard dimensions and tolerances. The pipe shall be machined on each end to properly receive the coupling and gasket.

3.12 Hydrostatic Test: Each standard, random, or short length of pipe and each coupling for the corresponding pipe shall have sufficient strength to hold an internal hydrostatic test for each type of pipe equal to four times the working pressure of the pipe as shown in the following table.

TYPE OF PIPE	TEST PRESSURE
50 Foot Head or 22 PSI	200 Foot Head or 88 PSI
100 Foot Head or 43 PSI	400 Foot Head or 172 PSI
150 Foot Head or 65 PSI	600 Foot Head or 260 PSI

3.13 Flexural Strength: Each standard length of pipe in sizes 4", 6" and 8" shall have sufficient beam strength to withstand without failure the total applied load specified below when tested as described in Section 4.22.

TOTAL APPLIED LOAD - LBS.

NOMINAL PIPE SIZE	50 FOOT HEAD		100 FOOT HEAD		150 FOOT HEAD	
INCHES	9' SPAN	12' SPAN	9' SPAN	12' SPAN	9' SPAN	12' SPAN
4	550	415	1000	620	1000	750
6	1500	1125	2000	1500	2000	1500
8	3000	2250	3000	2250	3000	2250

CAPCO KIN 0000289

SECTION 3 - DETAIL REQUIREMENTS: (Continued)

3.14 Crushing Strength: Each pipe when tested shall have sufficient strength, when submitted to the ASTM three-edge bearing test as specified in Section 4.23, to support not less than the loads indicated in the following table:

MINIMUM CRUSHING STRENGTH

NOMINAL PIPE SIZE INCHES	50 FOOT HEAD	100 FOOT HEAD	150 FOOT HEAD
4	1500	2000	2500
6	1500	2000	2500
8	1500	2000	2500
10	1500	2000	2500
12	1500	2000	2500
14	1500	2000	2500
16	1500	2000	2500

3.2 Couplings: Asbestos-Cement Couplings shall be machined on the inside surface so that the gaskets are retained in the proper position to make a tight seal.

3.3 Rubber Gaskets: The rubber gaskets shall conform to the manufacturer's standards.

3.4 Chemical Requirements: The Uncombined Calcium Hydroxide in Permaflex* Asbestos-Cement Low Head Pipe and couplings shall not be greater than 1 percent when tested by the methods described in Section 4.24.

SECTION 4 - INSPECTION, TESTS AND REJECTIONS:

4.1 General: All material furnished under this specification shall be inspected and tested in a normal air-dry condition prior to shipment for conformance to the requirements stated in previous sections. When required on his order, the purchaser may witness inspection and test procedures at his own expense. In lieu of this, he may request the manufacturer to submit a certificate certifying the product meets the requirements of this specification.

4.2 Tests:

4.21 Hydrostatic Test: Each pipe regardless of length, each coupling and adaptor shall be tested under a hydrostatic pressure of four times the working pressure for the type of pipe. The water pressure shall be applied gradually and maintained at the specified test level for 5 seconds. Any pipe or coupling showing any defect shall be rejected.

*Reg. U. S. Pat. Off.

CAPCO KIN 0000290

SECTION 3 - DETAIL REQUIREMENTS, Addendum

3.14 Crushing Strength

MINIMUM CRUSHING STRENGTH

NOMINAL PIPE SIZE INCHES	50 FOOT HEAD	100 FOOT HEAD	150 FOOT HEAD
18	1500	2000	2500
20	1500	2000	2500
24	1500	2000	2500

Specification amended January 1, 1972 to include production from Van Bruen, Arkansas plant.

*Reg. U. S. Pat. Off.

CAPCO KIN 0000291

4.22 Flexural Strength: Each standard 13 foot length of 4", 6" and 8" pipe shall be tested in flexure. The test shall be conducted by supporting the pipe in a flexural testing machine with supports 9 or 12 feet apart. The load shall be applied at a uniform rate until it equals the test loads specified in Section 3.13. The total load shall be divided equally and applied at the third points of the clear span at a uniform loading of at least 500 pounds per second.

4.23 Crushing: From each 300 lengths of pipe, or fraction thereof, of each size and class when specifically requested by the purchaser on his order, one length shall be selected by the inspector for a three-edge bearing test before shipment. From each selected length, there shall be cut one unmachined section of pipe one foot long. This section shall be tested by the ASTM three-edge bearing method and shall not fail until the total applied load exceeds the applicable value shown in Section 3.14. The rate of loading shall be 2,000 pounds per minute per lineal foot, with a tolerance of plus or minus 500 pounds per minute per lineal foot.

4.24 Uncombined Calcium Hydroxide Test: The manufacturer shall conduct periodic controlled Uncombined Calcium Hydroxide tests. Upon request, certifications shall be issued to the customer that the pipe and couplings will conform to the requirements of maximum Uncombined Calcium Hydroxide permitted under 3.4.

Reagents:

A. Phenolphthalein Indicator: Dissolve 1 g of phenolphthalein in 100 ml of absolute ethanol.

B. Glycerol - Ethanol Solvent - Prepare a solution consisting of glycerol: anhydrous or absolute ethanol - 1:2 by volume (commercial solvents consisting of 95% absolute ethanol and 5% isopropanol may be substituted). To each liter of this mixture 2 ml of the indicator is added. Adjust the solvent to slightly basic with either dilute NaOH in absolute ethanol or standard ammonium acetate, depending on the original pH.

C. Standard Ammonium Acetate Solution (1 ml = 0.005 g CaO) Dissolve 16g dry crystalline ammonium acetate in one liter of absolute or anhydrous ethanol. The solution is standardized against known amount of pure CaO by titrating a mixture of 0.05-0.06 g ground CaO, 60 nl of the glycerol-ethanol solvent, and 2 g of anhydrous strontium nitrate $Sr(NO_3)_2$ to a colorless end point. When the solution is boiled for 10 minutes, no color should appear. If color appears, continue titration.

CAPCO KIN 0000292

Procedure: Representative samples of pipe or sleeve shall be prepared and immediately screened through a 20 mesh screen. Place the material passing through the screen immediately into a weighing bottle and cover with its ground glass top.

Place the bottle with top removed into a drying oven at 105° C for 2 hours and then cool in a desiccator to room temperature.

Weigh out 1 g $\pm$ 0.010 g of the prepared sample to the nearest 0.001 g, and place it into a dry 250 Erlenmeyer flask, to which a teflon encapsulated stirring bar, 60 ml of the glycerol-ethanol reagent and 2 g of Sr $(NO_3)_2$ are added. Attach flask to a water-cooled condenser (with standard 24/40 glass joint) and place on hot plate-magnetic stirrer. Boil the solution gently for 30 minutes with mild stirring, then remove the flask and filter the mixture on a Buchner funnel under vacuum. Bring filtrate to a boil and titrate with standardized ammonium acetate to the end point. The end point is observed by comparison with a similar mixture containing no phenolphthalein indicator. No excess ammonium acetate should be added at any time, because an excess may react with calcium silicates and aluminates.

Calculation:

A. Standardization of Ammonium Acetate Solution

$$E = \frac{W_{CaO}}{Va} \times 1.32$$

where E = weight of $Ca(OH)_2$ in g/ml of ammonium acetate solution

W_{CaO} = weight of CaO in grams

Va = volume of Ammonium Acetate in ml

B. Percentage of Uncombined $Ca(OH)_2$ in % $= \frac{EV}{W} \times 100$

where V = Volume of ammonium acetate solution required by sample in ml

W = Weight of sample in grams to nearest 0.001.

4.3 Rejection: If the specimen tested for crushing strength fails to attain 100 percent of the crushing load required in Section 3.14 one specimen shall be cut from each of two additional pipes of the same size and lot. Failure of one of these additional specimens to meet the strengths specified in Section 3.14 shall be cause for rejection of the entire lot.

*Reg. U. S. Pat. Off.

Printed in U.S.A.

CAPCO KIN 0000293

SECTION 5 - MARKING:

5.1 Pipe: Each standard, random and short length of pipe shall be marked with the manufacturer's name, trade name "Permaflex,"* nominal size, class, working pressure, and a "T" to signify it was tested, and date of manufacture.

5.2 Coupling Sleeves: The component parts of each coupling shall be clearly marked with the make and size of pipe for which they are intended.

5.3 Gaskets: Each rubber gasket shall be marked with the manufacturer's identification, the size, and year of manufacture.

SECTION 6 - PREPARATION FOR SHIPMENT:

6.1 General: Permaflex* Irrigation Pipe and Couplings shall be prepared for standard commercial shipment so as to assure acceptance by common or other carriers.

SECTION 7 - SUPPLEMENTARY DETAILS TO BE SPECIFIED BY PURCHASER:

7.1 General: When purchasing Permaflex Low Head Pipe under these specifications, it will be necessary for the purchaser to make specific statements for each lot of pipe.

7.2 Laying Length: The purchaser shall state the total laying length of each size and class of pipe required.

7.21 Short Lengths: The purchaser shall state the total footage of short lengths which shall be required.

7.3 Types: The purchaser shall state the type or types of pipe required.

7.4 Inspection and Tests: When the purchaser wishes to witness the inspection and tests conducted by the manufacturer, he shall so state on his order so that the manufacturer can notify the purchaser in ample time. All expense incidental to this inspection shall be assumed by the purchaser.

7.41 Certificate of Test: When the purchaser requires a certificate of test in lieu of witnessing the inspection and test procedure, he shall so state on his order.

7.42 Crushing Test: When the purchaser requires that the crushing tests be conducted on pipe, he shall so state on his order.

7.43 Uncombined Calcium Hydroxide Tests: When the purchaser requires that the Uncombined Calcium Hydroxide Tests be conducted, he shall so state on his order.

CAPCO KIN 0000294

IRRIGATION PIPE

	SIZE	LIST PRICE	LESS 23½%
50-FOOT HEAD			
	8"	$ 1.53	$ 1.17
	10"	1.95	1.50
	12"	2.37	1.82
	14"	3.38	2.60
	16"	4.23	3.25
100-FOOT HEAD			
	8"	1.75	1.34
	10"	2.18	1.67
	12"	2.86	2.19
	14"	4.08	3.12
	16"	5.15	3.94
150-FOOT HEAD			
	8"	1.89	1.45
	10"	2.54	1.94
	12"	3.48	2.66

FBT/gw
October 9, 1968

CAPCO KIN 0000295

JENNINGS, CARTER & THOMPSON
PATENT LAWYERS
SUITE 1414 BANK FOR SAVINGS BUILDING
BIRMINGHAM, ALABAMA 35203

HENRY L JENNINGS
HUGH P. CARTER
WOODFORD R. THOMPSON, JR.
ROBERT D. JOHNSTON (1903-1940)

PATENTS
TRADE MARKS

TELEPHONE
(205) 324-1524

February 19, 1970

Carl Moebes, Esq.
Woodward Corporation
Woodward, Alabama

Dear Carl:

We enclose herewith copy of an Office action which we have received from the Patent Office in the matter of the trademark application Serial No. 331,859 "CAPCO".

We also enclose a copy of an amendment which we have forwarded to the Patent Office in response to this action.

This is for your information and files. We will keep you advised of further developments.

Very truly yours,

JENNINGS, CARTER & THOMPSON

By: Hugh P. Carter

HPC:lt
Enclosure

cc: Mr. Weaver
(w/enclosure)

CAPCO KIN 0000296

IN THE UNITED STATES PATENT OFFICE

In re: Application of

Cement Asbestos Products Company

Serial No. 331,859 — Div. IV
Examiner W.J. Parker

Filed July 7, 1969

For CAPCO

- - - - - -

1414 Bank for Savings Building

Birmingham, Alabama 35203

February 19, 1970

Hon. Commissioner of Patents

Washington, D. C. 20231

Sir:

In response to Office letter of February 9, 1970, applicant is pleased to enclose its installation guidd and its material specification CA102 69.

Concerning classification, it would not appear particularly pertinent from applicant's standpoint which class the Examiner suggests is proper. Therefore, the Examiner is asked to classify the goods properly and amend the goods accordingly.

Publication is respectfully requested.

Respectfully,

JENNINGS, CARTER & THOMPSON

By:
Hugh P. Carter

HPC:lt

Telephone Area Code 205 - 324-1524

U.S. DEPARTMENT OF COMMERCE
PATENT OFFICE
WASHINGTON, D.C. 20231

ADDRESS ONLY
THE COMMISSIONER OF PATENTS
TRADEMARK EXAMINING OPERATION
WASHINGTON, D.C. 20231

JENNINGS, CARTER & THOMPSON
1414 Bank for Savings Bldg.
Birmingham, Ala. 35203

(Please Furnish Your Zip Code In All Correspondence)

Paper No. 1

IN REPLY PLEASE REFER TO:

Serial No. 331,859 | Mailed FEB 9 1970

Mark CAPCO

Applicant Cement Asbestos Products Company

On examination, it would appear applicant's pipes and compliugs belon in Class 12 rather than 13. Inquiry is made under Rule 2.61(b) whether illustrative literature may be filed to assist the examiner on this matter of classification. In the absence of such amendment to Class 12 may be offered.

Reply is cordially awaited.

A search of the Office records fails to show that the mark, when applied to applicant's goods, is confusingly similar to any registered mark.

WJParker:lcs (557-3277) Examiner, Div. IV

A proper response to this Office action must be received within 6 months from the date of this action in order to avoid ABANDONMENT.

FORM POL-95 (REV 6-68)

3 - Applicant's Duplicate Copy

CAPCO KIN 0000298

Int. Cl.: 19

Prior U.S. Cl.: 12

United States Patent and Trademark Office

10 Year Renewal

Reg. No. 902,028

Registered Nov. 10, 1970

Renewal Approved Sep. 10, 1990

TRADEMARK
PRINCIPAL REGISTER

CAPCO

CAPCO PIPE COMPANY, INC. (ALABAMA CORPORATION)
1400 20TH STREET SO.
BIRMINGHAM, AL 35255, BY CHANGE OF NAME FROM CEMENT ASBESTOS PRODUCTS COMPANY (ALABAMA CORPORATION) BIRMINGHAM, AL

FOR: CEMENT ASBESTOS PIPES AND COUPLINGS FOR SUCH PIPE, IN CLASS 12 (INT. CL. 19).

FIRST USE 6-24-1969; IN COMMERCE 6-24-1969.

SER. NO. 72-331,859, FILED 7-7-1969.

In testimony whereof I have hereunto set my hand and caused the seal of The Patent and Trademark Office to be affixed on Oct. 23, 1990.

CAPCO KIN 0000299

United States Patent Office

902,028
Registered Nov. 10, 1970

PRINCIPAL REGISTER
Trademark

Ser. No. 331,859, filed July 7, 1969

CAPCO

Cement Asbestos Products Company (Alabama corporation)
2144 Highland Ave. S.
Birmingham, Ala. 35205

For: CEMENT ASBESTOS PIPES AND COUPLINGS FOR SUCH PIPE, in CLASS 12 (INT. CL. 19).
First use June 24, 1969; in commerce June 24, 1969.

CAPCO KIN 0000300

United States Patent Office

801,330
Registered Jan. 4, 1966

PRINCIPAL REGISTER
Trademark

Ser. No. 214,428, filed Mar. 18, 1965

PERMAFLEX

Cement Asbestos Products Company (Alabama corporation)
Woodward, Ala.

For: GASKETS FOR CEMENT ASBESTOS PIPE JOINTS, in CLASS 35.
First use Feb. 16, 1965; in commerce Feb. 16, 1965.

P. S. BALL, *Examiner.*

CAPCO KIN 0000301

90-150

JENNINGS, CARTER & THOMPSON
PATENT LAWYERS
SUITE 1414 BANK FOR SAVINGS BUILDING
BIRMINGHAM, ALABAMA 35203

HENRY L JENNINGS
HUGH P. CARTER
WOODFORD R. THOMPSON, JR.

ROBERT O. JOHNSTON (1903-1940)

PATENTS
TRADE MARKS

TELEPHONE
(205) 324-1524

August 6, 1970

Carl Moebes, Esq.
Woodward Company
Woodward, Alabama

Re: Trademark "CAPCO"

Dear Carl:

We are pleased to advise that the above trademark will be published in the Patent Office Official Gazette of August 25, 1970.

If no notice of opposition is filed within the thirty-day period following said date of publication, the Commissioner of Patents will issue the Certificate of Registration in about three months.

We will keep you advised of developments in the case.

Very truly yours,

JENNINGS, CARTER & THOMPSON

By: Hugh P. Carter

HPC:lt

cc: Mr. Weaver
Dr. Brookbank

JENNINGS, CARTER & THOMPSON
PATENT LAWYERS
SUITE 1414 BANK FOR SAVINGS BUILDING
BIRMINGHAM, ALABAMA 35203

HUGH P. CARTER
WOODFORD R. THOMPSON, JR.

ROBERT D. JOHNSTON (1903-1940)
HENRY L. JENNINGS (1927-1969)

PATENTS
TRADE MARKS

TELEPHONE
(205) 324-1524

November 12, 1970

Carl Moebes, Esq.
Woodward Company
Woodward, Alabama

Dear Carl:

We are pleased to hand you herewith trademark registration No. 902,028 dated November 10, 1970 covering "CAPCO".

The goods or the containers therefor bearing this mark should bear the notation "Registered in the United States Patent Office" or "Reg. U.S. Pat. Off." or by placing an R within a circle thus: (R).

The duration of this registration is twenty (20) years and the same may be renewed prior to that time for a succeeding period of twenty (20) years, etc. Under the statute an affidavit of continued use must be filed in the Patent Office not earlier than the fifth year after the date of the certificate nor later than the sixth year thereafter, that is, between the period of November 10, 1975 and November 10, 1976. If this is not done, the registration will be cancelled. Only one such affidavit is required to be filed.

It is recommended that you make a note of the above date, and set the same up on your records for action five years hence. We will also place this mark on our docket and attempt to call the same to your attention when action is next due.

With best wishes, we are

CAPCO KIN 0000303

Yours very truly,

JENNINGS, CARTER & THOMPSON

By: Hugh P. Carter
Hugh P. Carter

11/16/70
Copy of letter and enclosure to Mr. Smitherman for Company's file. Please note 5 year date.

Copy of letter to Mr. Bond, Mr. Davis, Mr. W. Bagley, Mr. Davis Weaver, Mr. Lee Taylor — [illegible]

HPC:lt
Enclosure

cc: Dr. Brookbank
Mr. Weaver
(less/encls.)

cas-10

Cement Asbestos Products Company

Woodward, Alabama

To: All Salesmen September 7, 1967

From: Mr. Lee Taylor

Subject: Gravity Sewer Pipe Brochure

Enclosed is the copy for the proposed PERMAFLEX® Sewer Pipe Brochure. This has been prepared by Francis Pool working with our advertising agency and is a publication we all long wanted.

I would like for you to read it carefully and send any comments and suggestions for change which you may have after reading.

ILT/gj
Enclosure

LUCKIE & FORNEY, INC. / ADVERTISING
MARKETING / PUBLIC RELATIONS

Box 7484-A / 11 Office Park, Birmingham, Alabama 35223 · Area 205 · 871-7335

COPY

client WOODWARD IRON - CEMENT ASBESTOS date July 31, 1967 dpaa

C/A Gravity Sewer Pipe Brochure
Page 1 (Cover)

(This cover page is to be in the same style as the cover for PERMAFLEX WATER PIPE MATERIAL SPECIFICATION CA 102 66 herewith.)

PERMAFLEX

GRAVITY SEWER PIPE

MATERIAL SPECIFICATION CAG 101 67

(logo) C/A

Conformance:
ASTM-C-428
Fed. Spec. SS-P-331b

CEMENT ASBESTOS PRODUCTS COMPANY

Woodward, Alabama 35189

CAPCO KIN 0000305

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Box 7484-A / 11 Office Park, Birmingham, Alabama 35223 · Area 205 · 871-7335

COPY

client WOODWARD IRON - CEMENT ASBESTOS - 2 date July 31, 1967 dpaa

SHORT FORM SPECIFICATION - Gravity

MATERIALS:

Pipe, couplings and fittings shall be composed of a mixture of portland cement or portland-pozzolana cement, silica and asbestos fiber --- and shall be free from organic substances --- shall be autoclave-cured to produce 1% or less uncombined calcium hydroxide (free lime content) for type II pipe.

LENGTHS:

Standard Lengths shall be 13-feet in all sizes and classes. Up to 10% of the total footage of any one size and class may be furnished in random lengths 7-feet or more.

Short Lengths-half lengths available, all classes, sizes 6" through 12" for use in making rigid connections to fittings or structures.

JOINTS:
(2) Permaflex
One Coupling and two solid rubber rings shall be furnished with each length of pipe. Coupling shall be factory applied to one end of each standard length of pipe.

FITTINGS:

Sewer Pipe tees, wyes, and elbows shall be made of the same material as the pipe and furnished in classes suitable for the class of pipe with which they will be used.

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(MORE)

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C/A Gravity Sewer Pipe Brochure
Page 2 (Cont'd)

SOUNDNESS TESTS:

(a) Hydrostatic Test of 50 psi shall be applied for 5 seconds to each pipe length.

(b) Flexural Test shall be applied to each standard length of 6- and 8-inch pipe.

(c) Crushing Test shall be applied to pipe sample taken from each lot of 100 lengths of each size and class of pipe.

CLASSES AND DIMENSIONS:

Class equals Crushing Strength (ASTM 3-Edge Bearing Method)		Nominal Sizes Inside Diameters (in.)
1500	4, 5, 6,	8, 10, 12, 14, 16
2400	4, 5, 6,	8, 10, 12, 14, 16
3300	4, 5, 6,	8, 10, 12, 14, 16
4000	See note	10, 12, 14, 16
5000	below	10, 12, 14, 16

Note: Stub sewers to properly line shall be Perma-flex stub sewer pipe furnished in sizes 4", 5" and 6" in 6'6" & 13' lengths. Not hydrostatically tested. They shall be furnished in crushing strengths (ASTM 3-Edge Bearing Method) of 1500, 2400 or 3300 lbs. per ft. Perma-flex sewer main furnished 6"-16".

(MORE)

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MARKETING / PUBLIC RELATIONS

Box 7484-A / 11 Office Park, Birmingham, Alabama 35223 · Area 205 · 871-7335

COPY

client WOODWARD - CEMENT ASBESTOS - 4 date August 1, 1967 dpaa

INFILTRATION - EXFILTRATION - Gravity

C/A specification calls for 100 gals. per inch per mile per day. The economic advantages of this specification are:

Less Infiltration --- ground water kept outside

(1) smaller size pipe --- capacity required for sewage only

(2) smaller treatment plants --- capacity required for treating sewage only

(3) less chemicals (numbers & volume)

(4) less wear on system

(5) less labor to build, operate, maintain the system

(6) less chance of sand entering joints and causing expensive problems in both sewer line and treatment plant (slowing of velocity of flow --- mixing with grease and building up --- removal, etc.)

Less Exfiltration (Leakage) --- sewage kept inside pipe (in dry areas no ground water problem).

In addition to possible pollution of soil and water supplies, a sewer leak may bring on another serious problem. When sewer pipes leak the surrounding soil becomes moist and as the leakage continues the moist

(MORE)

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C/A Gravity Sewer Pipe Brochure
Page 2 (Cont'd)

area may increase --- they are likely to eventually come into contact with root growths of some kind (except in desert areas). The roots will follow the path of the liquid until finally they enter the opening (origin of leakage) in the sewer joint. Once inside, the root, feeding on the liquid and bacteria of the sewage, grows until it finally blocks the sewer line completely.

This necessitates expensive periodic cleaning or possibly even more expensive digging up of the line and replacing.

CRUSHING STRENGTH

(ASTM 3-EDGE BEARING METHOD)

Gravity

	MINIMUM TEST REQUIREMENT				
SIZE	TOTAL APPLIED LOAD LBS. PER LINEAR FT.				
Pipe Inches	CLASS 1500	CLASS 2400	CLASS 3300	CLASS 4000	CLASS 5000
4	1500	2400	3300	-	-
5	1500	2400	3300	-	-
6	1500	2400	3300	-	-
8	1500	2400	3300	-	-
10	1500	2400	3300	4000	5000
12	1500	2400	3300	4000	5000
14	1500	2400	3300	4000	5000
16	1500	2400	3300	4000	5000

(logo) C/A CEMENT/ASBESTOS PRODUCTS COMPANY Woodward, Alabama 35189

(MORE)

CAPCO KIN 0000309

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C/A Gravity Sewer Pipe Brochure
Page 3

COMPARATIVE CRUSHING STRENGTHS

SEWER, DRAIN AND CULVERT PIPES - C/A - CLAY - CONCRETE

A.S.T.M. 3-EDGE BEARING METHOD (IN POUNDS PER LINEAR FOOT)

	C/A PIPE					CLAY		CONCRETE		REINFORCED CONCRETE CULVERT, STORM DRAIN AND SEWER				
SIZE Pipe Inches	A.S.T.M. SPEC. C-428 CLASS					Std. Strgth. A.S.T.M. Spec.	Extra Strgth. A.S.T.M. Spec.	Std. Strgth. A.S.T.M. Spec.	Extra Strgth. A.S.T.M. Spec.	A.S.T.M. SPEC. C-76-62T CLASS				
	1500	2400	3300	4000	5000	C-13-57T	C-200-59T	C-14-59	C-14-59	I	II	III	IV	V
	Minimum Strength Requirements					Av. Strength Req.		Min. Strength Req.		Load to Produce a 0.01" Crack				
6	1500	2400	3300	-	-	1100	2000	1100	2000	-	-	-	-	-
8	1500	2400	3300	-	-	1300	2000	1300	2000	-	-	-	-	-
10	1500	2400	3300	4000	5000	1400	2000	1400	2000	-	-	-	-	-
12	1500	2400	3300	4000	5000	1500	2250	1500	2250	-	1000	1350	2000	3000
14	1500	2400	3300	4000	5000	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	1750	2750	1750	2750	-	1250	1688	2500	3750
16	1500	2400	3300	4000	5000	-	-	-	-	-	-	-	-	-

CAPCO KIN 000310

(MORE)

LUCKIE & FORNEY, INC. / ADVERTISING
MARKETING / PUBLIC RELATIONS

Box 7484-A / 11 Office Park, Birmingham, Alabama 35223 · Area 205 · 871-7335

copy

client WOODWARD - CEMENT ASBESTOS - 7 - date August 2, 1967 dpaa

C/A Gravity Sewer Pipe Brochure
Page 3 (Cont'd).

SIZES and WEIGHTS Where pipe length not indicated, weight based on 13' length

Gravity

SIZE	CLASS 1500		CLASS 2400		CLASS 3300		CLASS 4000	CLASS 5000
Pipe Inches	Pipe wgt. lbs. per ft.-Inc. cplg. & 2 rings		Pipe wgt. lbs. per ft.-Inc. cplg. & 2 rings		Pipe wgt. lbs. per ft.-Inc. cplg. & 2 rings		Pipe wgt. lbs. per ft.-Inc. cplg. & 2 rings	Pipe wgt. lbs. per ft.-Inc. cplg. & 2 rings
	0'0"	0'0"	0'0"	0'0"	0'0"	0'0"		
4	N/A*	0.0	0.0	0.0	0.0	0.0	-	-
5	0.0	0.0	0.0	0.0	0.0	0.0	-	-
6	0.0	0.0	0.0	0.0	00.0	00.0	-	-
8	00.0	-	12.8		14.5		-	-
10	17.1		17.7		20.5		22.7	25.8
12	22.2		22.9		27.0		29.6	33.6
14	27.7		28.9		34.0		37.3	42.0
16	33.3		35.3		41.1		45.4	51.0

need figures to go here.

CAPCO KIN 0000311

NATIONAL ADVERTISING AGENCY NETWORK MEMBER • In consideration of the reduced rate at which the contents of this unit and attached exhibits, if any, are released, said contents and exhibits, insofar as they have originated with Luckie & Forney, Inc. or any of its employees, are to be regarded as unpublished manuscript, property of Luckie & Forney, Inc. released for the sole information of the party to whom addressed, and all common law right of reproduction or publication is expressly with held by Luckie & Forney, Inc., as proprietor. The acceptance of this unit will be construed as an admission of its exclusive ownership by Luckie & Forney, Inc. at its home office in Birmingham, Alabama.

C/A Gravity Sewer Pipe Brochure
Page 3 (Cont'd)

PIPE and COUPLING DIMENSIONS

Gravity

SIZE	ALL CLASSES				CLASS (All 5 columns D_7* dimension)					ALL CLASSES	CLASS 1500	2400	3300	4000	5000	
Pipe Inches	D	D_2	D_3	D_6	1500	2400	3300	4000	5000	D_8	D_9*	D_9*	D_9*	D_9*	D_9*	CLA
4	4.00	4.62	4.74	5.09	5.86	5.86	6.05	-	-	4.73	4.81	4.87	5.03	-	-	4
5	5.00	5.66	5.78	6.13	7.00	7.00	7.19	-	-	5.77	5.90	5.97	6.15	-	-	4
6	6.00	6.66	6.78	7.13	7.98	7.98	8.18	-	-	6.77	6.92	6.98	7.14	-	-	4
8	8.00	8.80	8.96	9.38	10.31	10.31	10.31	-	-	8.91	9.02	9.04	9.22	-	-	6
10	10.00	10.89	11.05	11.47	12.42	12.42	12.42	12.58	12.78	11.00	11.12	11.16	11.36	11.50	11.70	6
12	12.00	12.99	13.15	13.57	14.50	14.50	14.66	14.82	15.04	13.10	13.22	13.26	13.50	13.64	13.86	7
14	14.00	15.07	15.23	15.77	16.77	16.77	16.87	17.03	17.27	15.20	15.30	15.36	15.62	15.78	16.00	8
16	16.00	17.15	17.31	17.85	18.97	18.97	19.05	19.23	19.49	17.28	17.38	17.46	17.72	17.90	18.14	8

(logo) C/A CEMENT/ASBESTOS PRODUCTS COMPANY Woodward, Alabama 35189

(MORE)

CAPCO KIN 0000312

LUCKIE & FORNEY, INC. / ADVERTISING
MARKETING / PUBLIC RELATIONS

Box 7484-A / 11 Office Park, Birmingham, Alabama 35223 · Area 205 · 871-7335

COPY

client WOODWARD - C/A ASBESTOS - 9 - date August 2, 1967 dpaa

C/A Gravity Sewer Pipe Brochure
Page 4 - Crush Strength Backfill Load Table

CRUSH STRENGTH
BACKFILL LOADS

In Pounds per Lineal Foot

Imposed on Pipe in Trenches by

Granular Material — W = 100 lbs. per cu. ft.

$\frac{\text{ASTM 3-E x B.F.}}{\text{SF}}$ = Safe Load — SF = Safety Factor = 1.5

BF = Bedding Factor = 1.5 or 1.15

Depth of Fill above Pipe in Feet	WIDTH OF TRENCH AT TOP OF PIPE IN FEET						
	2'0"	2'6"	3'0"	3'6"	4'0"	5'0"	6'0"
4	550	725	950	1100	1300	1700	2100
5	650	875	1100	1300	1500	2000	2500
6	700	975	1230	1500	1800	2400	2900
7	750	1075	1375	1700	2000	2700	3350
8	800	1150	1500	1850	2200	2950	3700
9	850	1200	1600	2000	2400	3200	4000
10	880	1275	1700	2100	2550	3400	4300
12	920	1375	1800	2300	2800	3890	4900
14	975	1450	1900	2500	3000	4250	5500
16	1000	1500	2020	2650	3200	4575	6000
18	1000	1530	2100	2750	3400	4875	6400
20	1025	1550	2150	2850	3550	5100	6700
22	1025	1575	2200	2920	3680	5250	7025
24	1040	1590	2200	2950	3680	5500	7300
26	1040	1600	2200	3000	3850	5625	7575
28	1040	1600	2250	3000	3850	5750	7750
30	1050	1600	2300	3000	3900	5800	8000

Class 1500
BF = 1.15

Marston's Formula $W_c = C_d \, w \, B_d^2$

Class 1500
BF = 1.5

Class 2400
BF = 1.15

Class 2400
BF = 1.5

CAPCO KIN 0000313

(MORE)

NATIONAL ADVERTISING AGENCY NETWORK MEMBER • In consideration of the reduced rate at which the contents of this unit and attached exhibits, if any, are released, said contents and exhibits, insofar as they have originated with Luckie & Forney, Inc. or any of its employees, are to be regarded as unpublished manuscript, property of Luckie & Forney, Inc. released for the sole information of the party to whom addressed, and all common law right of reproduction or publication is expressly withheld by Luckie & Forney, Inc., as proprietor. The acceptance of this unit will be construed as an admission of its exclusive ownership by Luckie & Forney, Inc. at its home office in Birmingham, Alabama.

LUCKIE & FORNEY, INC. ADVERTISING
MARKETING PUBLIC RELATIONS

Box 7484-A 11 Office Park, Birmingham, Alabama 35223 · Area 205 · 871-7335

COPY

client WOODWARD - CEMENT ASBESTOS - 10 - date August 2, 1967 dpaa

C/A Gravity Sewer Pipe Brochure
Page 5

DESIGN DATA

C/A for gravity sewer lines offers the highest strength in 16" dia. and down --- has the lowest ratio of weight to crushing strength.

HYDROSTATIC STRENGTH

Each standard, random and short length of C/A Sewer Pipe* is subjected to an internal pressure of 50 pounds. Pipe evidencing leakage or seepage through the pipe wall rejected.

*Not applicable to sewer pipe for stubs.

FLEXURAL STRENGTH

SIZE Pipe Inches	LENGTH Pipe Feet	TOTAL APPLIED LOAD, LB. CLASS 1500	CLASS 2400	CLASS 3300
6	13	0000	0000	0000
8	13	0000	-	-
8	13	-	4100	4800

need figures here

(MORE)

CAPCO KIN 0000314

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Copy

C/A Gravity Sewer Pipe Brochure
Page 5 (Cont'd)

GRAVITY SEWER PIPE BEDDING TECHNIQUES

(illus.) A. Impermissible Bedding - Load Factor: 1.1

Ditch foundation not shaped to fit pipe. Random distribution of backfill, careless tamping.

(illus.) B. Ordinary Bedding - Load Factor: 1.5

Some care given to shaping ditch beneath pipe across a width one-half the diameter of the pipe. Granular materials placed by hand and tamped to provide backfill compactness.

(illus.) C. First Class Bedding - Load Factor: 1.9

Pipe is nested on fine granular materials carefully shaped to fit pipe bottom across 60% of its diameter. Backfill placed by hand in 6-inch layers to a depth of at least 12-inches above the pipe. Each layer carefully tamped to insure effective compaction.

(illus.) D. Concrete Cradle Bedding - Load Factor: 2.2 - 3.4

Pipe bottom bedded in plain or reinforced concrete of efficient thickness, and extended upward about the pipe to a proportion of its height, as determined by the engineer.

(MORE)

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COPY

C/A Gravity Sewer Pipe Brochure
Page 6

PERMAFLEX COUPLING FOR GRAVITY SEWER PIPE

No exfiltration, because C/A's Permaflex system gives a tight O-ring seal regardless of pressure. It is a self-sealing connection like nothing else in the industry. If you want a demonstration, ask our representative.

(illus) (illus)

Ready for assembly Assembly completed

FIELD TAPPING CEMENT/ASBESTOS GRAVITY SEWER PIPE

Cut-in branch connections are made quickly on the job using power or hand tools

(illus)

CEMENT/ASBESTOS OFFERS A COMPLETE LINE

T's	Increasers
Y's	Manhole stubs
Angles	Sewer end caps
90° Bends	Plastic end plugs

All fittings 6" through 16"
End plugs 4" and 6"

CAPCO KIN 0000316

(logo) C/A CEMENT ASBESTOS PRODUCTS COMPANY Woodward, Alabama 35189

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Cca-10

Cement Asbestos Products Company

To: All Salesmen and Frank Dill April 17, 1968

From: Lee Taylor

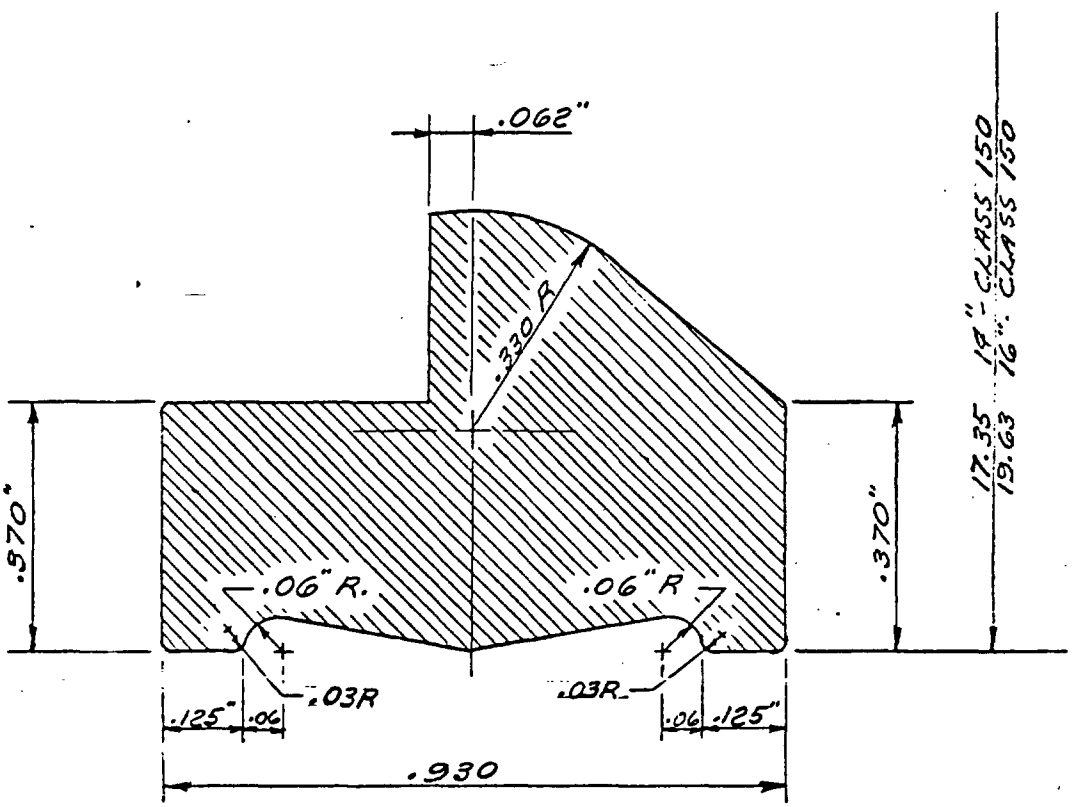
Subject: Change in PERMAFLEX® Gasket

The 14" and 16" PERMAFLEX® gasket will be modified per the attached drawing. This gasket has been extensively tested in our laboratory and plant, and it is felt that this design makes a good gasket an even better one. The amount of pressure needed to assemble is no more than the old gasket, and this gasket has even greater stability in the gasket grove. After field experience with 14" and 16", we may wish to modify the other diameter.

Lee

ILT/rb

CAPCO KIN 0000317



14" & 16" PRESSURE PIPE GASKET REVISION

CAPCO KIN 0000318

CEMENT ASBESTOS PRODUCTS CO. RAGLAND, ALABAMA			14" & 16" CLASS 150 PERMAFLEX GASKET REVISION	
DRAWN: L.A.	APPROVED:	SCALE: —	DATE: 10-24-67	DWG. NO. A-36

WOODWARD COMPANY
A DIVISION OF THE MEAD CORPORATION
June 1, 1970

FROM: Mr. W. R. Bond

TO: Staff Members and Division Heads

SUBJECT: Divisional Legal Affairs

In a recent memorandum, Mr. J. W. McSwiney, President of The Mead Corporation, outlined responsibility for legal matters at the divisional level, together with provided guidance for discharging that responsibility.

I am confident that I have the full cooperation of each and every one of you in this vital area, and the purpose of this memorandum is, therefore, to establish concise and workable procedures for use within our own division and also for use in our contacts with corporate headquarters and other divisions of Mead.

No change in counsel is contemplated at any division of Woodward, nor will there be any change in procedure except as noted in this letter.

The divisions of Woodward are permitted to employ previously authorized counsel in the same type of situations as in the past. Also, consistent with past practices, they will clear with Mr. Davis or me prior to employing legal counsel in all other circumstances.

All legal counsel performing services for divisions of Woodward will render statements on a quarterly basis (or if a significant amount of service is involved, on a monthly basis). Also, each division is responsible for providing a copy of each statement for legal services, on a current basis, to Mr. Carl Moebes, at Woodward's General Office

In addition to the regular quarterly report currently being submitted, a detailed report of all law suits, or substantial claims against the company, should be forwarded to me, with a copy to Mr. Moebes, as promptly as possible after the suit has been filed.

If there are any questions about responsibilities in carrying out the announced policy on legal matters, they should be referred to Mr. Davis.

Yours truly,

W R Bond

CAPCO KIN 0000319

MEMORANDUM FOR THE FILE June 27, 1968

On Tuesday morning, June 25, 1968, a meeting was held in the New York office of American Smelting and Refining Company to discuss Cement Asbestos Products Company's proposed new cement-asbestos pipe plant and plastic pipe plant. Present at this meeting were Messrs. R. D. Bradford, F. G. Hamrick, W. R. Bond, all directors of Cement Asbestos Products Company; plus H. Clay Davis, and C. W. Adair, officers of Woodward Corporation.

The new Cement Asbestos Products Company's pipe plant and the plastic pipe plant were approved by the Board of Directors of Woodward Corporation on June 7, 1968, pending availability of a building in Fort Smith, Arkansas, or other property.

Based on S. D. Weaver's final survey after the above meeting, it was decided that a new building should be constructed for housing these two projects on property in Van Buren, Arkansas, rather than purchase the building in Fort Smith which was formerly occupied and owned by the Ohio Rubber Company.

It was unanimously agreed by those present at this meeting that both projects should be undertaken and gotten under way as set forth in the proposals on these projects which had previously been sent to the directors of Cement Asbestos Products Company as well as the directors of Woodward Corporation.

The original agreement between American Smelting and Refining Company and the Woodward Corporation stated that participation of the two companies in Cement Asbestos Products Company, a joint venture, would be on the basis of 60 per cent for Woodward Iron Company and 40 per cent for American Smelting and Refining Company, and added that any additional plants constructed by Cement Asbestos Products Company in an eleven-state territory as set out would entitle American Smelting to equal participation with Woodward, or on a 50-50 percentage basis. However, it was agreed at this meeting on June 25, that the terms of the original agreement would be amended to prorate participation in Cement Asbestos Products Company on the basis of 51 per cent for Woodward Corporation and 49 per cent for American Smelting and Refining Company, with the adjustment in invested capital to be accomplished by contribution in the above proposed construction.

This is to notify all Board members of Cement Asbestos Products Company that construction will proceed based on the foregoing authorization.

W R Bond

President, Cement Asbestos Products Company.

Copy to all Capco Directors

CAPCO KIN 0000320

FIREMAN'S FUND AMERICAN INSURANCE COMPANIES

WORKMEN'S COMPENSATION/GENERAL LIABILITY CLAIMS EXHIBIT

INSURED	POLICY NUMBER	POLICY PERIOD	PAGE	EDITION
WOODWARD IRON COMPANY	WP 115 2687	1-1-68-69	1	1
PRODUCER: Marsh & McLennan - Atlanta, Georgia			VALUATION DATE: 3-1-62	

CLAIM NUMBER	DATE OF LOSS	CLAIMANT — AGE SEX — OCCUPATION	ACCIDENT DESCRIPTION	LOCATION OF LOSS	LOSS INCURRED INDEMNITY B/I	LOSS INCURRED MEDICAL P/D	ALLOC. EXPENSE PAID	OTHER EXPENSE PAID	OF CLO REC
Cement Asbestos Products, Woodward, Alabama									
602 C 157152	2-5-68	H.Bean- Laborer	Hurt arm	Ragland,Ala.		27			C
				PAGE CLOSED TOTALS		27			
				PAGE OPEN TOTALS					

X — INDICATES CHANGE IN CLAIM STATUS

110214-9-67

CAPCO KIN 0000321

Form 33

Bailey Meissner Company
1213 Scott Street
Wichita Falls, Texas

SHEET NO. 1

DATE	REFERENCE	CHARGES	CREDITS	BALANCE
JAN 1959	111	3.087.83		3.087.83*
[illegible] CS			3.087.83=	3.087.00*

CAPCO KIN 0000322

Form 33

Southwest Meter & Supply Co., Inc.
P.O.Box 638
Marshall, Texas

SHEET NO. 1

DATE	REFERENCE	CHARGES	CREDITS	BALANCE
[illegible]	3.551	3,711.76		
[illegible]	3.731	3,729.70		
[illegible]	3.721	3,711.76	3,729.70	3,729.70
[illegible] CS				.00

REDACTED

CAPCO KIN 0000323

Form 33

Johnson-Burke SupplyCompany, Inc.
(Plumbing & Heating Suppliers)
Sherman, Texas

SHEET NO. 1

DATE	REFERENCE	CHARGES	CREDITS	BALANCE
JAN 2 '68	511	3,840.65		3,840.65
FEB 1 '68 CS			3,840.65-	.00

REDACTED

CAPCO KIN 00003

Form 33

Moore Supply Company 3409 21st St
~~3409 Twenty First Street~~
Lubbock, Texas ~~79407~~ 79410

SHEET NO. 1

DATE	REFERENCE	CHARGES	CREDITS	BALANCE
APR [illegible]	3.071	4.232.25	4.232.25-	4.232.25*
[illegible]	CS			.00::

REDACTED

CAPCO KIN 000032

orm 33

The Perry Shankle Co.
1801 South Flores P O Box 1569
San Antonio, Texas 78296

SHEET NO. 1

DATE	REFERENCE	CHARGES	CREDITS	BALANCE
[illegible]	711	13,820.99		13,820.99*
[illegible] CS			13,820.99-	.00*
[illegible]	3,101	2,282.86		2,282.86*
[illegible]	3,431	3,145.28		5,428.14*
[illegible]	3,781	3,077.42		8,505.56*
[illegible]	4,121	287.52		8,793.08*
[illegible]	4,471	2,849.90		11,642.98*
[illegible] CS			3,145.28-	8,497.70*
[illegible] CS			2,282.86-	6,214.84*
[illegible] CS			3,077.42-	3,137.42*
[illegible]	4,851	2,616.93		5,754.35*
[illegible] CS			287.52-	5,466.83*
[illegible]	5,521	3,578.35		9,045.18*
[illegible] CS			2,849.90-	6,195.28*
[illegible] CS			2,616.93-	3,578.35*
[illegible] CS			3,578.35-	.00*
[illegible]	7,091	3,695.74		3,695.74*
[illegible] CS			3,695.74-	.00*
[illegible]	10,011	7,163.30		7,163.30*
[illegible] CS			7,163.30-	.00*
[illegible]	11,501	4,535.23		
[illegible]	11,771	2,439.24		7,024.47*
[illegible]	12,651	2,399.94		9,424.41*
[illegible] CS			7,024.47-	2,399.94*
[illegible]	13,031	2,636.05		5,035.99*
[illegible] CS			2,399.94-	2,636.05*

REDACTED

CAPCO KIN 0000326

Fitting Supply Company Inc.
1300 South 11th Street
Waco, Texas

SHEET NO. 1

DATE	REFERENCE	CHARGES	CREDITS	BALANCE
[illegible]	1071	5,744.67		
[illegible]	2341		2,271.72-	5,744.67*
[illegible]	CS	3,707.02		9,451.69*
[illegible]	CS		5,744.67-	3,707.02*
[illegible]	CS		3,707.02-	.00*
[illegible]	8151	3,095.30		3,095.30*
[illegible]	9061	3,493.26		6,588.56*
[illegible]	CS		3,095.30-	3,493.26*
[illegible]	CS		3,493.26-	.00*
[illegible]	13191	3,752.71		

RED

CAPCO KIN 0000327

MATERIAL
AND SUPPLIES
PURCHASE ORDER

67-45-L-16

67-46-L-16

Show this Initial and Number on Invoices, Bill of Lading and Packages

RM-34

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

1-12-67 bw

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

1/14-1/19.30, 297.76
1/19-1/23.30, 297.76

Lake Asbestos of Quebec
P. O. Box 608
Black Lake
Quebec, Canada

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF W. H. Beasley, S. K.

SHIP TO: RAGLAND, ALA. Ragland, Ala. Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. Blk Lake
150 150 300	tons	4T3 Asbestos Fibre	@ $ 190.00 ton
		+ 5% Surcharge	

Terms: 1% 10 Days

Del. : 150 tons immediately
150 tons 1 week later

"Confirmation"
Farrell 12-30-66 P

PURCHASING DEPT. COPY

CHARGE D/Chg. 9-2 Asbestos

EST. COST $57,000.00 12-30-66

CEMENT ASBESTOS PRODUCTS COMPANY

H K Stokes

H. K. STOKES, DIRECTOR OF PURCHASES

JAN 11 1967

W. H. Beasley — Storekeeper
Superintendent
S. K. Wiener — General Superintendent

CAPCO KIN 0000328

MATERIAL
AND SUPPLIES
PURCHASE ORDER

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35188

Show this Initial and Number on Invoices, Bill of Lading and Packages
RM-36

2-6-67 bw

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

Lake Asbestos of Quebec
P. O. Box 608
Black Lake
Quebec, Canada

1/31-2/8-14,873.03
2/2-2/8-30,402.35

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF W. H. Beasley, S. K.

SHIP TO: RAGLAND, ALA. Ragland, Ala. Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. S. P.
100	tons	Asbestos 5R3 Poly Bags	@ $ 132.00 ton
150	tons	Asbestos 4T3 Poly Bags	@ 190.00 ton

+ 5% Surcharge

Terms: 1% 10 Days

Del. : 1 week

"Confirmation"
Beierle 1-27-67 P

IMPORTANT
Items furnished on this Purchase Order will not be accepted [illegible] and manufactured in the [illegible] Your invoice must be certified to this effect by your President or his designated authority.

PURCHASING DEPT. COPY

CHARGE D/Chg. 9-2 Asb. $14,500.
9-3 " $30,000.
EST. COST $44,500. 1-30-67

CEMENT ASBESTOS PRODUCTS COMPANY
H K Stokes
H. K. STOKES, DIRECTOR OF PURCHASES

FEB 6 1967

W. H. Beasley
Storekeeper

Superintendent

W. W. Jemison
General Superintendent

CAPCO KIN 0000329

MATERIAL
AND SUPPLIES
PURCHASE ORDER

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

Show this Initial and Number on Invoices, Bill of Lading and Packages
RM-37

2-10-67 bw

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

North American Asbestos Corporation
200 South Michigan Avenue
Chicago, Illinois 60604

4/11-4/14-23,415.00
4/26-6/1-70, 906.25

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF W. H. Beasley, S. K.

SHIP TO: RAGLAND, ALA. Ragland, Ala. Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B.
200 (105)	tons (9375)	Open Cape "S" Blue Asbestos Fibre @ $	223.00 Net ton

Terms: Net 10 Days

Del. : 100 tons immediately
100 tons 3-4 weeks later

"Confirmation"
Cryor 2-7-67 P

IMPORTANT
Items furnished on this Purchase Order will not be accepted unless purchased and manufactured in the United States of America. Your invoice must be certified to this effect by your President or his designated authority.

PURCHASING DEPT. COPY

CHARGE D/Chg. 9-5 Asbestos R. M.

EST. COST $44,600.00 2-8-67

CEMENT ASBESTOS PRODUCTS COMPANY

H. K. Stokes

H. K. STOKES, DIRECTOR OF PURCHASES

FEB 10 1967

W. H. Beasley — Storekeeper
Superintendent
W. W. Jemison — General Superintendent

CAPCO KIN 0000330

MATERIAL
AND SUPPLIES
PURCHASE ORDER

67-262

Show this Initial and Number on Invoices, Bill of Lading and Packages

RM-38

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

2-22-67 bw

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

Lake Asbestos of Quebec
P. O. Box 608
Black Lake
Quebec, Canada

3/1-3/6 - 40,536.47

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF W. H. Beasley, S. K.

SHIP TO: RAGLAND, ALA. Ragland, Ala. Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. Blk. Lake
200	tons	Asbestos 4T3 Poly Bags	@ $ 190.00 NT

+ 5% surcharge

Terms: 1% 10 Days

Del. : 1 week

IMPORTANT
Items furnished on this Purchase Order will not be accepted unless purchased and manufactured in the United States of America. Your invoice must be certified to this effect by your President or his designated authority.

PURCHASING DEPT. COPY

CHARGE D/Chg. 9-2 RM Asbestos

EST. COST $38,000.00 2-20-67

CEMENT ASBESTOS PRODUCTS COMPANY

H. K. Stokes

H. K. STOKES, DIRECTOR OF PURCHASES

W. H. Beasley — Storekeeper

FEB 21 1967

Superintendent

W. W. Jennison — General Superintendent

CAPCO KIN 0000331

MATERIAL
AND SUPPLIES
PURCHASE ORDER

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

Show this Initial and Number on Invoices, Bill of Lading and Packages
RM-42

3-28-67 bw

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

Lake Asbestos of Quebec
P. O. Box 608
Black Lake
Quebec, Canada

3/23 - 3/29. 40,444. 46 73
3/31 - 4/3 - 40, 481

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF W. H. Beasley, S. K.

Ragland, Ala. Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. Blk Lake
300	tons	4T# Asbestos Poly Bags	@ $ 190.00 NT
150	tons	5R3 Asbestos Poly Bags	@ 132.00 NT

Terms: 1% 10 Days

Del. : 200 tons 4T3 Ship 3-24-67
100 tons 4T3 & 150 tons 5R3
Ship 3-30-67

"Confirmation"
Farrell 3-20-67 P

PURCHASING DEPT. COPY

CHARGE D/Chg. 9-2-$57,000 Asbestos
9-3 $19,800 "

EST. COST $76,800 3-20-67

CEMENT ASBESTOS PRODUCTS COMPANY
H. E. STOKES, DIRECTOR OF PURCHASES

MAR 27 1967

Storekeeper | Superintendent | General Superintendent

CAPCO KIN 0000334

MATERIAL
AND SUPPLIES
PURCHASE ORDER

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

67-581
Show this Initial and Number on Invoices, Bill of Lading and Packages
RM-40

5-3-67 bw

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

Lake Asbestos of Quebec
P. O. Box 608
Black Lake
Quebec, Canada

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF W. H. Beasley, S. K.

Ragland, Ala. | Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. Blk Lake
200 tons		Asbestos 4T3 Poly Bag	@ $ 198.00 net ton
		+ 5% Surcharge	

Terms: 1% 10 Days

Del. : 1 week

PURCHASING DEPT. COPY

CHARGE D/Chg. 9-2 Asbestos
EST. COST $~~39,600.00~~ 39,600.00 5-2-67

CEMENT ASBESTOS PRODUCTS COMPANY
H. K. Stokes
H. K. STOKES, DIRECTOR OF PURCHASES

MAY 3 1967

S. R. Beasley
Storekeeper

Superintendent

W. W. Jones
General Superintendent

MATERIAL
AND SUPPLIES
PURCHASE ORDER

67-7.5 L.318

Show this Initial and Number on Invoices, Bill of Lading and Packages

SM-43

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

6-5-67 bw

47012 11

Lake Asbestos of Quebec
P. O. Box 608
Black Lake
Quebec, Canada

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF W. H. Beasley, S. K.

Roqland, Ala. Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. Blk Lake
224	Tons	Asbestos 4T3 Poly Bags	@ $ 198.00NT
		+ 5% Surcharge	

Terms: 1% 10 Days

Del. : 1 week

"Confirmation"
Farrell 5-31-67 P

IMPORTANT
Items furnished on this Purchase Order will not be accepted unless purchased and manufactured in the United States of America. Your invoice must be certified to this effect by your President or his designated authority.

PURCHASING DEPT. COPY

CHARGE D/Chg. 9-2 Asbestos
EST. COST $44,352.00 5-31-67

CEMENT ASBESTOS PRODUCTS COMPANY

H. K. STOKES, DIRECTOR OF PURCHASES

Storekeeper | Superintendent | General Superintendent

CAPCO KIN 0000336

MATERIAL
AND SUPPLIES
PURCHASE ORDER

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

Show this initial and Number on Invoices, Bill of Lading and Packages
RM-44

6-26-67 bw

EXEMPT FROM ALABAMA
SALES OR USE TAX

North American Asbestos Corporation
200 South Michigan Avenue
Chicago, Illinois 60604

11/30-12/6 22,300.00
12/29-1/8 22,300.00

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF W. H. Beasley, S. K.

RAGLAND, ALA. Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. CIF Mobile
200 (100) (100)	tons	Cape S Blue Fibre	@ $ 223.00 net ton

Terms: Net 10 Days

Del. : 100 tons 1st July
100 tons end July

"Confirmation"
Joan Holtz 6-21-67 P

PURCHASING DEPT. COPY

CHARGE P/Chg. 9-5 Blue Asb.

EST. COST $44,600.00 6-23-67

CEMENT ASBESTOS PRODUCTS COMPANY

H. K. STOKES, DIRECTOR OF PURCHASES

Recommended:

JUN 26 1967

W. W. Jemison Approved:

W. A. Beasley
Storekeeper

MATERIAL
AND SUPPLIES
PURCHASE ORDER

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189
7-17-67-jw

Show this Initial and Number on Invoices, Bill of Lading and Packages
RM-45

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

Lake Asbestos of Quebec
P. O. Box 608
Black Lake
Quebec, Canada

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF W. H. Beasley, S. K.

RAGLAND, ALA. | Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. Blk Lake
224 ✓	tons	4T3 Asbestos Fibre	@ $ 198.00 ✓ Net Ton
		5% Surcharge ✓	

Car Nos. CP-55007
266246
249221
51792

Terms: 1% 10 Days ✓

Del. : 1 week

"Confirmation"
Farrell 7-5-67 P

PURCHASING DEPT. COPY

CHARGE D/Chg. 9-2 Asbestos
EST. COST $44,352.00 7-5-67

CEMENT ASBESTOS PRODUCTS COMPANY
H. K. STOKES, DIRECTOR OF PURCHASES

Recommended: JUL 17 1967
W. W. Jemison Approved:
W. H. Beasley
Storekeeper

MATERIAL
AND SUPPLIES
PURCHASE ORDER

67-955-6424

Show this Initial and Number on Invoices, Bill of Lading and Packages

RM-46

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

7-18-67 bw

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

Lake Asbestos of Quebec, Ltd.
Subsidiary of American Smelting & Refining Co.
P. O. Box 608
Black Lake
Quebec, Canada

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF W. H. Beasley, S. K.

RAGLAND, ALA. Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. Blk Lake
224	tons	Asbestos 4T3 Poly Bags	@ $ 198.00 N ton
		+ 5% Surcharge	

To be shipped wk 7/17/67

Terms: 1% 10 Days

ack-7/17/67 Del. : 1 week

"Confirmation"
Farrell 7-17-67 P

PURCHASING DEPT. COPY

CHARGE D/Chg. 9-2 Asbestos

EST. COST $44,352.00 7-17-67

CEMENT ASBESTOS PRODUCTS COMPANY

H. K. STOKES, DIRECTOR OF PURCHASES

Recommended:

W. B. Beasley
Storekeeper

W. W. Johnson
Approved: JUL 18 1967

CAPCO KIN 0000339

MATERIAL
AND SUPPLIES
PURCHASE ORDER

67.1732-L729

Show this Initial and Number on Invoices, Bill of Lading and Packages

RM-47

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

11-20-67-bw

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

Lake Asbestos of Quebec, Ltd.
Subsidiary of American Smelting & Refining Co.
P. O. Box 608
Black Lake
Quebec, Canada

11/27-11/29-47,478-2.3

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF W. H. Beasley, S. K.

RAGLAND, ALA. Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. Blk Lake
200 (224)	tons	4T3 Asbestos Poly Bags + 5% Surcharge	@ $ 198.00 n ton

Terms: 1% 10 Days

Del. : 1 week

"Confirmation"
Farrell 11-17-67 P

PURCHASING DEPT. COPY

CHARGE D/Chg. 9-2 Asbestos

EST. COST $39,600.00 11-17-67

CEMENT ASBESTOS PRODUCTS COMPANY

H. K. STOKES, DIRECTOR OF PURCHASES

Recommended:

NOV 20 1967

Approved:

W. T. Beasley
Storekeeper

CAPCO KIN 0000340

MATERIAL
AND SUPPLIES
PURCHASE ORDER

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189
12-13-67-jw

Show this initial and Number on Invoices, Bill of Lading and Packages
RM-48

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

Lake Asbestos of Quebec, Ltd.
P. O. Box 608
Black Lake, Quebec
Canada

12/18-12/26. 55,000. ##

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF W. H. Beasley, S. K.

RAGLAND, ALA. Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O. Blk Lake
280	tons	Asbestos 4T3 Poly Bags	@ $ 198.00 Net ton
		+ 5% Surcharge	

Terms: 1% 10 Days

Del. : 1 week

"Confirmation"
Farrell 12-11-67 P

PURCHASING DEPT. COPY

CHARGE D/Chg. 9-2 Asbestos

EST. COST $55,440.00 12-12-67

CEMENT ASBESTOS PRODUCTS COMPANY

H. K. STOKES, DIRECTOR OF PURCHASES

Recommended:

DEC 13 1967

W. W. Jemison Approved:

W. A. Beasley
Storekeeper

CAPCO KIN 0000341

MATERIAL
AND SUPPLIES
PURCHASE ORDER

Show this Initial and Number on Invoices, Bill of Lading and Packages
RM-49

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

1-10-68-jw

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

North American Asbestos Corporation
200 South Michigan Avenue
Chicago, Illinois 60604

2/20-2/26-22,500.00
3/29-4/2-22,500.00
5/12-5/20 22,500.00

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF W. H. Beasley, S. K.

RAGLAND, ALA. Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. Mobile
300	tons	Cape S Blue Asbestos Fiber	@ $ 225.00 net ton

100
100
100

Terms: Net 10 Days

Del. : 100 tons mid-Feb.
100 tons mid-Mar.
100 tons mid-Apr.

"Confirmation"
Cryor 12-18-67 P

PURCHASING DEPT. COPY
D/Chg. 9-5 Blue Asb.
CHARGE $67,500.00 1-3-68
EST. COST

CEMENT ASBESTOS PRODUCTS COMPANY
H. K. STOKES, DIRECTOR OF PURCHASES

Recommended:
JAN 10 1968
Approved:

R. G. Jackson
Storekeeper

W. H. Beasley

CAPCO KIN 0000342

MATERIAL
AND SUPPLIES
PURCHASE ORDER

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

Show this Initial and Number on Invoices, Bill of Lading and Packages
RM-52

1-17-68-bw

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

Lake Asbestos of Quebec
P. O. Box 608
Black Lake, Quebec
Canada

1/25-1/29. 52,497.73

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF W. H. Beasley, S. K.

RAGLAND, ALA. Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. Blk Lake
250 280	tons	Asbestos Grade 4T3 Pressure packed poly bags	@ $ 198.00 net ton
		+ 5% Surcharge ~~Invoiced~~	

250 short tons ack. 1/24/68

Terms: 1% 10 Days

Del. : 1 week

"Confirmation"
Mrs. Cooper 1-15-68 P

PURCHASING DEPT. COPY

CHARGE D/Chg. 9-2 Asbestos
EST. COST $55,440.00 1-16-68

CEMENT ASBESTOS PRODUCTS COMPANY
H. K. Stokes
H. K. STOKES, DIRECTOR OF PURCHASES

Recommended: JAN 17 1968

W. H. Jamison Approved:

R. G. Jackson
Storekeeper

W. H. Beasley

CAPCO KIN 0000343

MATERIAL
AND SUPPLIES
PURCHASE ORDER

64.136 L60

Show this Initial and Number on Invoices, Bill of Lading and Packages
RM-53

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

1-29-68-bw

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

Lake Asbestos of Quebec
P. O. Box 608
Black Lake, Quebec
Canada

1/25 · 2/2 · 52,447.73

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF R. G. Jackson, S. K.

RAGLAND, ALA. Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. Blk Lake
280	tons	Asbestos 4T3 Poly Bags	@ $ 198.00net ton
(250)		5% surcharge	

Terms: 1% 10 Days

Del. : 1 week

"Confirmation"
Farrell 1-24-68 P

ack - 1-24-68

PURCHASING DEPT. COPY

CHARGE D/Chg. 9-2 Asbestos

EST. COST $55,440.00 1-24-68

CEMENT ASBESTOS PRODUCTS COMPANY

H. K. STOKES, DIRECTOR OF PURCHASES

Recommended:

JAN 26 1968

Approved:

R. G. Jackson
Storekeeper

CAPCO KIN 0000344

MATERIAL
AND SUPPLIES
PURCHASE ORDER

68-95 21
68-1/5

Show this Initial and Number on Invoices, Bill of Lading and Packages
RM-54

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

2-2-68-bw

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

Lake Asbestos of Quebec
P. O. Box 608
Black Lake, Quebec
Canada

1/24-2/5-3670.92
1/26-2/5-3670.92

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF R. G. Jackson, S. K.

RAGLAND, ALA. Via Mtr. Frt.

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. Blk Lake
40	tons	Asbestos 4T3 Poly bags	@ $ 198.00net ton

5% surcharge ? trucked in probably won't be a surcharge

Terms: 1% 10 Days

Del. : 3 Days

"Confirmation"
Farrell 1-24-68 P

ck 20 tons shipped 1/24-C-2/1
ck 20 tons shipped 1/26-C-1/29/68

PURCHASING DEPT. COPY

CHARGE D/Chg. 9-2 Asbestos

EST. COST $7,920.00 1-24-68

CEMENT ASBESTOS PRODUCTS COMPANY

H. K. STOKES, DIRECTOR OF PURCHASES

Recommended: FEB 2 1968

Approved:

R. G. Jackson
Storekeeper

CAPCO KIN 0000345

MATERIAL
AND SUPPLIES
PURCHASE ORDER

68-173 L-70

Show this Initial and Number on Invoices, Bill of Lading and Packages

RM-55

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

2-9-68-bw

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

Lake Asbestos of Quebect, Ltd.
P. O. Box 608
Black Lake, Quebec
Canada

2/9-2/13-31,062.98

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF R. G. Jackson, S. K.

RAGLAND, ALA. Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. Blk Lake
224 (900)	tons	5R3 Asbestos poly bags @ $ ~~132.00~~ 140.00 net ton	
		+ 5% Surcharge	

ack. 2/4/68

Terms: 1% 10 Days

Del. : 1 week

"Confirmation"
Cooper 2-2-68 I

PURCHASING DEPT. COPY

CHARGE D/Chg. 9-3 Asbestos

EST. COST $29,568.00 2-2-68

CEMENT ASBESTOS PRODUCTS COMPANY

H. K. STOKES, DIRECTOR OF PURCHASES

Recommended:

Approved:

R. G. Jackson
Storekeeper

CAPCO KIN 0000346

MATERIAL
AND SUPPLIES
PURCHASE ORDER

68-282 4122

Show this Initial and Number on Invoices, Bill of Lading and Packages
RM-56

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

2-29-68-bw

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

Lake Asbestos of Quebec
P. O. Box 608
Black Lake, Quebec
Canada

2/26-3/5-73243.12

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF R. G. Jackson, S. K.

RAGLAND, ALA. Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. Blk Lake
336 (350)	tons	4T3 Asbestos poly bags	@ $ 198.00 net ton
		+ 5% Surcharge	

Terms: 1% 10 Days

Del. : 1 week

"Confirmation"
Farrell 2-26-68 P

2/27/68

PURCHASING DEPT. COPY

CHARGE D/Chg. 9-2 Asbestos

EST. COST $66,528.00 2-28-68

CEMENT ASBESTOS PRODUCTS COMPANY

H. K. STOKES, DIRECTOR OF PURCHASES

Recommended:

FEB 29 1968

Approved:

R. G. Jackson
Storekeeper

CAPCO KIN 0000347

MATERIAL
AND SUPPLIES
PURCHASE ORDER

68-311 L-132

Show this Initial and Number on Invoices, Bill of Lading and Packages
RM-57

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

3-4-68-bw

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

Lake Asbestos of Quebec
P. O. Box 608
Black Lake, Quebec
Canada

3/7-3/11-73,24/3.12

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF R. G. Jackson, S. K.

RAGLAND, ALA. Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. Blk Lake
336	tons	Asbestos 4T3 poly bags	@ $ 198.00 net ton

Terms: 1% 10 Days

Del. : 1 week

"Confirmation"
Farrell 3-1-68 P

PURCHASING DEPT. COPY

CHARGE D/Chg. 9-2 Asbestos
EST. COST $66,528.00 3-1-68

CEMENT ASBESTOS PRODUCTS COMPANY

H. K. STOKES, DIRECTOR OF PURCHASES

Recommended:

MAR 4 1968

Approved:

R. G. Jackson
Storekeeper

CAPCO KIN 0000348

MATERIAL
AND SUPPLIES
PURCHASE ORDER

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

Show this Initial and Number on Invoices, Bill of Lading and Packages
RM-58

3-6-68-bw

FOR RESALE, THEREFORE, EXEMPT FROM SALES OR USE TAX OF STATE OF ALABAMA

North American Asbestos Corporation
141 West Jackson Boulevard
Chicago, Illinois 60604

4/30-5/6-22,500.00
5/16-6/20-22,500.00
6/14-6/17-22,500.00
6/28-7/11-22,500.00
8/8-8/13-18,675.00

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

WIC [illegible] 8/29-78.75
8/30-9/9-3825.00

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF R. G. Jackson, S. K.

RAGLAND, ALA. Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. Mobile
500	tons	Cape S Blue Asbestos	@ $ 225.00 net ton

100 100 100 100 83 17

Terms: Net 10 Days

Del. : 100 tons mid- april
100 tons 1st May for storage
100 tons mid- May
100 tons mid- June
100 tons mid- July

"Confirmation"
Cryor 3-1-68 P

PURCHASING DEPT. COPY

CHARGE D/Chg. 9-5 Blue Asbestos

EST. COST $112,500.00 3-5-68

CEMENT ASBESTOS PRODUCTS COMPANY

H K Stokes

H. K. STOKES, DIRECTOR OF PURCHASES

Recommended:

W. W. Jemison

Approved: MAR 1968

R. G. Jackson
Storekeeper

W. D. Beasley

CAPCO KIN 0000349

MATERIAL
AND SUPPLIES
PURCHASE ORDER

61-39W/152

Show this Initial and Number on Invoices, Bill of Lading and Packages

RM-59

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

3-18-68-bw

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

Lake Asbestos of Quebec, Ltd.
P. O. Box 608
Black Lake, Quebec
Canada

3/29 4/2-13 934 15
5/9-5/17 96.63

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF R. G. Jackson, S. K.

RAGLAND, ALA. | Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. Blk Lake
50		tons Asbestos 4K3 polybags	@ $ 220.00 Ton
		+ 5% Surcharge	10 Tons 4A3 @ 335.00 Ton
			25 gallons @ 3.50 Ton

Terms: 1% 10 Days

Del. : 1 week

Shipment advised 3/21 ck 3/13/68

"Confirmation"
Farrell 3-13-68 P

PURCHASING DEPT. COPY

CHARGE D/Chg. 9-1 Asbestos
EST. COST $11,000.00 3-13-68

CEMENT ASBESTOS PRODUCTS COMPANY

H. K. STOKES, DIRECTOR OF PURCHASES

Recommended:

MAR 18 1968

W. W. Jemison Approved:

R. G. Jackson
Stock Keeper

W. W. Jemison

CAPCO KIN 0000350

MATERIAL
AND SUPPLIES
PURCHASE ORDER

68-494 L184

Show this Initial and Number on Invoices, Bill of Lading and Packages
RM-60

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

4-9-68-bw

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

Lake Asbestos of Quebec
P. O. Box 608
Black Lake, Quebec
Canada

4/2-4/9-47,821 42

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF R. G. Jackson, S. K.

RAGLAND, ALA. | Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. Blk Lake
200	tons	4T3 Asbestos poly bags	@ $ 201.50 ton

(224)

+ 5% surcharge

ack 4/2/68

Terms: 1% 10 Days

Del. : 1 week

"Confirmation"
Farrell 4-2-68 P

PURCHASING DEPT. COPY

CHARGE D/Chg. 9-2 Asbestos
EST. COST $40,300.00 4-5-68

CEMENT ASBESTOS PRODUCTS COMPANY

H. K. STOKES, DIRECTOR OF PURCHASES

Recommended:

APR 9 1968

W. W. Jemison Approved:

R. G. Jackson
Storekeeper

W. A. Bradley

CAPCO KIN 0000351

MATERIAL
AND SUPPLIES
PURCHASE ORDER

68-599 L234

Show this Initial and Number on Invoices, Bill of Lading and Packages

RM-61

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

4-29-68-bw

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

Lake Asbestos of Quebec, Ltd.
P. O. Box 608
Black Lake
Quebec, Canada

4/30 S/C. 44.169.29

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF

R. G. Jackson, S. K. RAGLAND, ALA. Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. Blk Lake
224	tons	4T3 asbestos poly bags palletize 1 car	@ $ 201.50 ton
		+ 5% surcharge	

Wooden pallets 91.16

Scheduled shipment 4/25 & 4/26
ok 4/23/68

Terms: 1% 10 Days

Del. : 1 week

"Confirmation"
Farrell 4-23-68 P

PURCHASING DEPT. COPY

CHARGE D/Chg. 9-2 Asbestos R.M.

EST. COST $45.136.00 4-26-68

CEMENT ASBESTOS PRODUCTS COMPANY

H. K. STOKES, DIRECTOR OF PURCHASES

Recommended:

W. W. Jemison

Approved:

PR 29 1968

R. G. Jackson
Storekeeper

W. W. Beasley

CAPCO KIN 0000352

MATERIAL
AND SUPPLIES
PURCHASE ORDER

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

61.6/2

Show this Initial and Number on Invoices, Bill of Lading and Packages

RM-64

5-13-68-bw

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

Lake Asbestos of Quebec, Ltd.
P. O. Box 608
Black Lake, Quebec
Canada

6/14.15/20 · 40,351.37

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF

R. G. Jackson, S. K. Ragland, Ala. | Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. Blk Lake
224		tons 4T3 Asbestos poly bags palletized	@ $ ~~203.25~~ 201.02 net ton
		+ 5% Surcharge	112 pallets @ 3.50 ea

Terms: 1% 10 Days

Del. : 2 weeks

"Confirmation"
Godfrey 5-8-68 P

PURCHASING DEPT. COPY

CHARGE D/Chg. 902 Asbestos

EST. COST $45,528.00 5-9-68

CEMENT ASBESTOS PRODUCTS COMPANY

H. K. STOKES, DIRECTOR OF PURCHASES

MAY 13 1968

R. G. Jackson
Storekeeper

Superintendent

General Superintendent

MATERIAL
AND SUPPLIES
PURCHASE ORDER

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

6X-6/14

Show this Initial and Number on Invoices Bill of Lading and Packages

RM-63

5-13-68-bw

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

Lake Asbestos of Quebec, Ltd.
P. O. Box 608
Black Lake, Quebec
Canada

5/14-5/20 · 13287.35

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF

R. G. Jackson, S. K. Ragland, Ala. | Via **Rail**

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. **Blk Lake**
56		**tons 4K3 Asbestos poly bags palletized**	$224.50 @ $ ~~220.00~~ **net ton**
		+ 5% Surcharge	

28 pallets 3.50 ea

TCH 5/9/68

Terms: 1% 10 Days

Del. : 2 weeks

"Confirmation"
Godfrey 5-8-68 P

PURCHASING DEPT. COPY

CHARGE **D/Chg. 9-1 Asbestos**

EST. COST **$12,320.00 5-9-68**

CEMENT ASBESTOS PRODUCTS COMPANY

H. K. STOKES, DIRECTOR OF PURCHASES

MAY 13 1968

R. G. Jackson
Storekeeper

Superintendent

W. W. Jamison
General Superintendent

SB.

MATERIAL
AND SUPPLIES
PURCHASE ORDER

68-76c

Show this Initial and Number on Invoices, Bill of Lading and Packages

RM-66

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

5-31-68-bw

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

Lake Asbestos Of Quebec
P. O. Box 608
Black Lake, Quebec
Canada

5/31-6/5-48, 351.37

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF

R. G. Jackson, S. K. RAGLAND, ALA. Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. Blk Lake
224	tons	4T3 asbestos poly bags, palletized + 5% surcharge	@ $ ~~203.25~~ 201.50 ton

112 pallets @ 3.50 ea

ack 5/27/68

Terms: 1% 10 Days

Del. : 2 weeks

"Confirmation"
Gagnor 5-27-68 P

PURCHASING DEPT. COPY

CHARGE D/Chg. 9-2 asbestos

EST. COST $45,528.00 5-27-68

CEMENT ASBESTOS PRODUCTS COMPANY

H K Stokes

H. K. STOKES, DIRECTOR OF PURCHASES

Recommended:

W. W. Jamison Approved: 1968

R. G. Jackson
Storekeeper

W. A. Bunly

CAPCO KIN 0000355

MATERIAL
AND SUPPLIES
PURCHASE ORDER

Show this Initial and Number on Invoices, Bill of Lading and Packages

RM-65

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

5-31-68-bw

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

North American Asbestos Corp.
~~141 West Jackson Boulevard~~
Chicago, Illinois 60604

8/30 - 9/9 - 22,500.00
9/30 - 10/4 - 22,500.00
11/6 - 11/11 - 22,500.00
Inv Corp 11/14 - 11/18 - 30.3.75 ...
3/31 - 4/7 - 45,000.00

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF

R. G. Jackson, S. K. RAGLAND, ALA. Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. Mobile
500	tons	Cape S Blue Asbestos	@ $ 225.00 net ton

100
100
100
200

Terms: Net 10 Days

Del. : 100 tons mid August
100 " " Sept.
100 " " Oct.
100 " " Nov.
100 " " Dec.

"Confirmation"
Cryor 5-27-68 P

ack L. 6/4/68

PURCHASING DEPT. COPY

CHARGE D/Chg. 9-5 Blue Asb.

EST. COST $112,500.00 5-27-68

CEMENT ASBESTOS PRODUCTS COMPANY

H K Stokes

H. K. STOKES, DIRECTOR OF PURCHASES

Recommended:

MAY 29 1968

W. W. Jemison

Approved:

R. G. Jackson

Storekeeper

W. H. Bundy

CAPCO KIN 0000356

MATERIAL
AND SUPPLIES
PURCHASE ORDER

68-861

Show this Initial and Number on Invoices, Bill of Lading and Packages

RM-68

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

6-17-68-bw

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

Lake Asbestos of Quebec, Ltd
P. O. Box 608
Black Lake, Quebec
Canada

6/27-7/12-26,600.

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF

R. G. Jackson RAGLAND, ALA. Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. Blk Lake
112	tons	4K3 Asbestos poly bags	@ $ 224.50 net ton
		Palletizing + 5% Surcharge	@ 3.50 ea 1.75 ton

56 pallets

Shipment scheduled week 6/17/68
ack 6/14/68

Terms: 1% 10 Days

Del. : 2 weeks

"Confirmation"
Gagnon 6-14-68 P

PURCHASING DEPT. COPY

CHARGE D/Chg. 9-1 Asbestos

EST. COST $$25,340.00 6-14-68

CEMENT ASBESTOS PRODUCTS COMPANY

H. K. STOKES, DIRECTOR OF PURCHASES

Recommended: JUN 17 1968

W. W. Jamison Approved:

W. D. Beasley

Storekeeper

CAPCO KIN 0000357

MATERIAL
AND SUPPLIES
PURCHASE ORDER

68.862

Show this Initial and Number on Invoices, Bill of Lading and Packages

RM-67

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

6-17-68-bw

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

Lake Asbestos Of Quebec, Ltd.
P. O. Box 608
Black Lake, Quebec, Canada

6/25-7/1- 48,398.10

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF

R. G. Jackson, S. K. RAGLAND, ALA. Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. Blk Lake
224	tons	4T3 Poly bagged asbestos	@ $ 201.50 net ton
		Palletizing 112	@ 3.50 ea ~~1.75 ton~~
		5% Surcharge	

Shipment scheduled week 6/17
ack 6/14/68

Terms: 1% 10 Days

Del. : 2 weeks

"Confirmation"
Gagnon 6-14-68 P

PURCHASING DEPT. COPY

CHARGE D/Chg. 9-2 Asbestos

EST. COST $45,528.00 6-14-68

CEMENT ASBESTOS PRODUCTS COMPANY

H. K. STOKES, DIRECTOR OF PURCHASES

JUN 17 1968

Recommended:

W. W. Jamison

Approved:

Storekeeper

CAPCO KIN 0000358

MATERIAL
AND SUPPLIES
PURCHASE ORDER

68-1047

Show this Initial and Number on Invoices, Bill of Lading and Packages
RM-69

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

8-9-68-bw

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

Lake Asbestos of Quebec, Ltd.
P. O. Box 608
Black Lake, Quebec
Canada

7/17-8/7-43,363.09
7/12-8/23-178.41 (additional fob due to fob in)

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF

R. G. Jackson, S. K. RAGLAND, ALA. Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. Blk Lake
224	tons	4T3 Asbestos poly bags	@ $ 201.50 net ton
(200)		~~Palletizing~~ + Surcharge 5%	@ ~~1.75 ton~~

112 pallets 3.50 ea

Terms: 1% 10 Days

Del. : 2 weeks

"Confirmation"
Godfrey 7-12-68 P

PURCHASING DEPT. COPY

CHARGE D/Chg. 9-2 Asbestos
EST. COST $45,528.00 7-12-68

CEMENT ASBESTOS PRODUCTS COMPANY
H. K. Stokes
H. K. STOKES, DIRECTOR OF PURCHASES

Recommended:

JUL 23 1968

W. W. Jenson Approved:

R. G. Jackson
Storekeeper

CAPCO KIN 0000359

MATERIAL
AND SUPPLIES
PURCHASE ORDER

68-1152

Show this Initial and Number on Invoices, Bill of Lading and Packages
RM-70

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

8-13-68-bw

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

Lake Asbestos of Quebec, Ltd.
P. O. Box 608
Black Lake, Quebec
Canada

8/16.8/19. 54,489.23

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF

R. G. Jackson, S. K. RAGLAND, ALA. Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. Blk Lake
250			
224	tons	Asbestos 4T3 poly bags	@ $ 201.50 net ton
		Palletizing	@ 1.75 ton
		+ Surcharge ~~5%~~ 4%	

14 pallets @ 3.50 ea

Terms: 1% 10 Days

Del. : 2 weeks

"Confirmation"
Mr. Roy 8-7-68 P

PURCHASING DEPT. COPY

CHARGE D/Chg. 9-2 Asbestos
EST. COST $45,528.00 8-9-68

CEMENT ASBESTOS PRODUCTS COMPANY

H. K. STOKES, DIRECTOR OF PURCHASES

Recommended:

AUG 12 1968

W. W. Jamison

Approved:

R. G. Jackson
Storekeeper

W. D. Beasley

CAPCO KIN 0000360

MATERIAL
AND SUPPLIES
PURCHASE ORDER

68-1239

Show this Initial and Number on Invoices, Bill of Lading and Packages
RM-71

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

8-26-68-bw

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

Lake Asbestos of Quebec
P. O. Box 608
Black Lake, Quebec
Canada

8/26-8/29-54,489.23

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF

R. G. Jackson, S. K. RAGLAND, ALA. Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. Blk Lake
250	tons	Asbestos 4T3 Poly bags @ $ 201.50 net ton	

Palletizing
+ Surcharge 5%

140 pallets 3.50 ea

Terms: 1% 10 Days

Del. : 2 weeks

"Confirmation"
Godfrey 8-21-68 P

not cert

IMPORTANT
Items furnished on this Purchase Order will not be accepted unless purchased and manufactured in the United States of America. Your invoice must be certified to this effect by your President or his designated authority.

PURCHASING DEPT. COPY

CHARGE D/Chg. 9-2 Asbestos
EST. COST $50,812.50 8-22-68

CEMENT ASBESTOS PRODUCTS COMPANY
H. K. STOKES, DIRECTOR OF PURCHASES

Recommended:

AUG 26 1968

W. W. Jennings

Approved:

R. G. Jackson
Storekeeper

W. H. Bissley

CAPCO KIN 0000361

MATERIAL
AND SUPPLIES
PURCHASE ORDER

68-13.5

Show this Initial and Number on Invoices, Bill of Lading and Packages

RM-73

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

9-9-68-bw

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

Lake Asbestos of Quebec, Ltd.
P. O. Box 608
Black Lake, Quebec
Canada

9/12-9/18-108,978.47

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF

R. G. Jackson, S. K. RAGLAND, ALA. Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. Blk Lake
500	tons	4T3 Asbestos in poly bags	@ $ 201.50 ton
		Palletizing	@ 1.75 ton
		Surcharge 5%	

2 80 pallets @ 3.50 ea
+ 4% surcharge on fob
Shipment to begin 9/6
ock. 9/5/68

Terms: 1% 10 Days

Del. : 2 weeks

"Confirmation"
Roy 9-5-68 P

PURCHASING DEPT. COPY

CHARGE D/Chg. 9-2 Asbestos

EST. COST $101,625.00 9-6-68

CEMENT ASBESTOS PRODUCTS COMPANY

H. K. STOKES, DIRECTOR OF PURCHASES

Recommended:

SEP 9 1968

W. W. Jemison

Approved:

R. G. Jackson
Storekeeper

W. D. Brady

CAPCO KIN 0000362

MATERIAL
AND SUPPLIES
PURCHASE ORDER

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

Show this Initial and Number on Invoices, Bill of Lading and Packages
RM-74

10-8-68-bw

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

North American Asbestos Corp.
200 South Michigan Avenue
Chicago, Illinois 60604

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF

R. G. Jackson, S. K. RAGLAND, ALA. Via **Rail**

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B.
200	tons	S80 Blue asbestos	@ $ 231.00 net ton CIF Mobile

Terms: Net 10 Days

Del. : Dec. 15th to be stored in Ala. Docks Whse

"Confirmation"
Holtz 10-1-68 P

PURCHASING DEPT. COPY

CHARGE **D/Chg. 9-5 Blue Asbestos**

EST. COST **$46,200.00 10-5-68**

CEMENT ASBESTOS PRODUCTS COMPANY

H. K. STOKES, DIRECTOR OF PURCHASES

Recommended:

OCT 7 1968

W. W. Johnson Approved:

R. G. Jackson
Storekeeper

CAPCO KIN 0000363

MATERIAL
AND SUPPLIES
PURCHASE ORDER

68-1563

Show this Initial and Number on Invoices, Bill of Lading and Packages

RM-76

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

10-16-68-bw

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

Lake Asbestos of Quebec
P. O. Box 608
Black Lake, Quebec
Canada

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF

R. G. Jackson, S. K. RAGLAND, ALA. Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. Blk Lake
250 (260)	tons	4T3 Asbestos polybags	@ $ 201.50 ton
		Palletizing	@ 140 3.50 ea
		+ Surcharge 5% 4%	

Terms: 1% 10 Days

Del. : 2 weeks

"Confirmation"
Roy 10-9-68 P

PURCHASING DEPT. COPY

CHARGE D/Chg. 9-2 Asbestos

EST. COST $51,250.00 10-14-68

CEMENT ASBESTOS PRODUCTS COMPANY

H. K. STOKES, DIRECTOR OF PURCHASES

Recommended:

OCT 16 1968

Approved:

R. G. Jackson
Storekeeper

MATERIAL
AND SUPPLIES
PURCHASE ORDER

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

Show this Initial and Number on Invoices, Bill of Lading and Packages
RM-75

11-4-68-bw

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

North American Asbestos Corp.
200 South Michigan Ave.
Chicago, Illinois 60604

10/31-116- 7240.

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF

R. G. Jackson, S. K. RAGLAND, ALA. Via **Rail**

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. **New Orlean**
30	ton	Cape S Blue	@ $ 243.00net ton

Terms: Net 10 Days

Del. : 1 week

"Confirmation"
Holtz 10-7-68 P

PURCHASING DEPT. COPY

CHARGE D/Chg. 9-5 Blue Asbestos

EST. COST $7,290.00 11-1-68

CEMENT ASBESTOS PRODUCTS COMPANY

H. K. STOKES, DIRECTOR OF PURCHASES

Recommended:

NOV 4 1968

W. W. Jemison Approved:

R. G. Jackson
Storekeeper

W. S. Beasley

CAPCO KIN 0000365

MATERIAL
AND SUPPLIES
PURCHASE ORDER

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

Show this Initial and Number on Invoices, Bill of Lading and Packages
RM-78

11-19-68-bw

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

Lake Asbestos of Quebec
P. O. Box 608
Black Lake, Quebec
Canada

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF

R. G. Jackson, S. K. RAGLAND, ALA. Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. Blk Lk
112	tons	Asbestos 5R3 poly bags palletized	@ $ 143.50 net ton
66	Pallets		@ 3.50 ea
		+ Surcharge 5%	

Terms: 1% 10 Days

Del. : 2 weeks

"Confirmation"
Roy 11-8-68 P

PURCHASING DEPT. COPY

CHARGE D/Chg. 9-3 Asbestos

EST. CO $16,464.00 11-15-68

CEMENT ASBESTOS PRODUCTS COMPANY

H. K. STOKES, DIRECTOR OF PURCHASES

Recommended:

R. G. Jackson
Storekeeper

Approved:

NOV 18 1968

CAPCO KIN 0000366

MATERIAL
AND SUPPLIES
PURCHASE ORDER

64-1.72c

Show this initial and Number on Invoices, Bill of Lading and Packages
RM-77

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

11-19-68-bw

FOR USE IN MINING, QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING. THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

Lake Asbestos of Quebec
P. O. Box 608
Black Lake, Quebec
Canada

11/25-12/2. 46,721#

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF

R. G. Jackson, S. K. RAGLAND, ALA. | Via **Rail**

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. **Blk Lake**
224	**tons**	**4T3 asbestos polybags**	@ $ **201.50 net ton**
		11 Pallets	@ **3.50 ea**
		+ Surcharge 5% 47-	

Terms: 1% 10 Days

Del. : 2 weeks

"Confirmation"
Roy 11-8-68 P

ic 11/6/68

PURCHASING DEPT. COPY

CHARGE **D/Chg. 9-2 Asbestos**

EST. COST **$45,920.00 11-15-68**

CEMENT ASBESTOS PRODUCTS COMPANY

H. K. STOKES, DIRECTOR OF PURCHASES

Recommended:

NOV 18 1968

W. W. Jamison Approved:

R. G. Jackson
Storekeeper

W. B. Beasley

CAPCO KIN 0000367

MATERIAL
AND SUPPLIES
PURCHASE ORDER

Show this Initial and Number on Invoices, Bill of Lading and Packages
RM-79

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA 35189

12-12-68-bw

FOR USE IN MINING; QUARRYING, COMPOUNDING, PROCESSING, OR MANUFACTURING, THEREFORE, EXEMPT FROM THE SALES OR USE TAX OF THE STATE OF ALABAMA.

Lake Asbestos of Quebec
P. O. Box 608
Black Lake, Quebec, Canada

12/31-1/10 - 24,221.14
1/10-1/21 26269.12

Please ship according to instructions given below, and mail invoices in triplicate, with transportation receipt to Cement Asbestos Products Company, Woodward, Alabama. All invoices must show terms of payment. Acknowledgment is required with full delivery information.

SHIP TO CEMENT ASBESTOS PRODUCTS COMPANY, CARE OF

R. G. Jackson, S. K. RAGLAND, ALA. Via Rail

QUANTITY	UNIT	DESCRIPTION	PRICE F.O.B. Blk Lake
224 (112) (112)	tons	Asbestos 4T3 poly bags	@ $ 201.50net ton (112)
		Pallets	@ 3.50 ea (112) 211.50 NT
		+ Surcharge 5% 4%	

Terms: 1% 10 Days

Del. : 2 weeks

"Confirmation"
Roy 12-5-68 P

PURCHASING DEPT. COPY

CHARGE D/Chg. 9-2 Asbestos

EST. COST $45,920.00 12-11-68

CEMENT ASBESTOS PRODUCTS COMPANY

H. K. STOKES, DIRECTOR OF PURCHASES

Recommended:

DEC 12 1968

W. W. Jameson

Approved:

R. G. Jackson
Storekeeper

W. A. Bundy

CAPCO KIN 0000368

OCT 5 1965.

OCT 5 1965

NORTH AMERICAN ASBESTOS CORPORATION

141 WEST JACKSON BOULEVARD • CHICAGO 4, ILLINOIS

TELEPHONE WABASH 2-1338

INVOICE No. 4623

DATE September 30, 1965

SOLD TO

Cement Asbestos Products Company

Woodward, Alabama

CUSTOMER ORDER NO. RM7

OUR ORDER NO. 1674

SHIPPED TO
Cement Asbestos Products Co.
Ragland, Alabama

SHIPPED VIA Richmond Frede & Potamac Delivery SHIPPING DATE September 24, 1965

QUANTITY	DESCRIPTION	PRICE	TOTAL
49.6 tons (992 bags)	Grade H Blue Fiber	@ $235.00 per ton f.o.b. Port of Philadelphia	$11,656.00
	Order Shipped Complete		
	Terms: Net 10 Days		

DATE APPROVED 10/5 SP
PRICE & TERMS APPROVED
CALCULATIONS
CHECKED
TRANSPORTATION
SAL # 43 4.00
SAL # 939 1653.17
FRT. BILL NO.
MATERIAL REC'D
10-2-65 DATE WHB REC'D BY
CHARGE 9-5E
LIST NO. 2 APPROVED
FINAL APPROVAL

EXEMPT FROM ALABAMA SALES OR USE TAX

CAPCO KIN 0000369

NOV 1 1965

NORTH AMERICAN ASBESTOS CORPORATION

141 WEST JACKSON BOULEVARD • CHICAGO 4, ILLINOIS

TELEPHONE WABASH 2-1338

INVOICE No. 4665

DATE October 29, 1965

CUSTOMER ORDER NO. RM-9

OUR ORDER NO. 4032

SOLD TO

Cement Asbestos Products Co.

Woodward, Alabama

SHIPPED TO

Cement Asbestos Products Co.
Ragland, Alabama

SHIPPED VIA RDG-Park Jct-B&O Pot Yds-SOL-SAL Delivery to your plant

SHIPPING DATE 10-20-65

QUANTITY	DESCRIPTION	PRICE	TOTAL
1.9 tons (38 bags)	Grade S Blue Fiber	@ $225.00 per ton	$ 427.50
9.45 tons (189 bags)	Grade TS Blue Fiber	@ $225.00 per ton	2,126.25
14.05 tons (281 bags)	Grade H Blue Fiber	@ $225.00 per ton	3,161.25
		f.o.b. Whse. Philadelphia	$5,715.00

Order Shipped Complete

Terms: Net Ten Days

REGISTER 212
INVOICE DATE 10 25
DATE TO BE PAID 11 12
LIST NO. 9 11 01
G/L ACCT. ab
INVOICE AMT. 571500
DISCOUNT
INCL. DISC.

CAPCO KIN 0000370

ARRIVAL NOTICE AND COPY OF BILL FOR PAYMENT OF FREIGHT CHARGES

TO SEABOARD AIR LINE RAILROAD COMPANY, HAS RECEIVED THE FOLLOWING ARTICLES CONSIGNED TO YOU

STATION Nov. 3, 1965 19

CONSIGNEE Ragland, Ala. Cement Asbestos Products Company

FREIGHT BILL NO 1111

ROUTE (POINT OF ORIGIN TO DESTINATION) RDG Pk Jct B&O Pot Yds [illegible] Rich SAL

WAYBILLED FROM Philadelphia, Pa.

WAYBILL DATE AND NUMBER 10-20-65 46519

FULL NAME OF SHIPPER N. American Asbestos Corp.

CAR INITIAL AND NUMBER Terminal Whse. PLE 30751

POINT AND DATE OF SHIPMENT

CONNECTING LINE REFERENCE

PREVIOUS WAYBILL REFERENCE

ORIGINAL CAR INITIAL AND NUMBER

WEIGHED AT Weight Agreement

GROSS

TARE

NET

TOFC PLAN

TRAILER

MEMORANDUM

NUMBER OF PACKAGES, ARTICLES AND MARKS	WEIGHT	RATE	FREIGHT	ADVANCES	TOTAL
38 BG Grade S Blue Asbestos Fiber					
189 BG Grade TS Blue asbestos fiber					
281 BG Grade H Blue asbestos fiber	51308	1.43	733.70		
Import Fgt X SS African Const..... P.S.....		.07		35.92	769.62
SLC					

N-1-65 57.57 286.34 425.71

53-2 (9-5 5E 5E

The above shipment to your consignment has arrived at this station, and is ready for delivery. Unless unloaded or removed within free period allowed by published rules, same will be subject to demurrage or storage charges, as provided for in said rules. Unless this shipment is removed promptly it will be subject to sale as provided in the terms of the bill of lading.

Please deliver this consignment to bearer

APPROVED-STORAGE

Consignee

Thank You-Your Business is Appreciated

MAKE CHECK PAYABLE TO SEABOARD AIR LINE RAILROAD COMPANY

CAPCO KIN 0000371

/977

KAW

CENTRAL ASBESTOS CO. LTD.

TELEPHONE
EAST 5711
P.B.X.

CENTRAL HOUSE
THOMAS ROAD
LONDON
E·14

CABLES & TELEGRAMS
CENBESTOS LONDON
TELEX 24211

Date 31.1.66

Cement Asbestos Products Co.
Woodward
Alabama

Your Order _____ Advice Note No. _____

10 bags	Cape Blue Asbestos S6	1000 lbs	@£70.0.0. per 2000 lbs* FOB DURBAN			
	Packed into 10 non-returnable bags S6 Marked: MOBILE PRODUCT OF THE REPUBLIC OF SOUTH AFRICA			35.	0.	0.
	Shipment from Durban Direct to Mobile per s.s. "Marjorie Lykes"					
	Freight as per bill of Lading			7.	2.	8.
	Insurance				4.	4.
	WE HEREBY CERTIFY THAT THIS IS A TRUE AND EXACT COPY OF THE ORIGINAL INVOICE. Per pro. CENTRAL ASBESTOS CO. LTD. M. C. Lutte		C.I.F.	£42.	7.	0.
				NO CHARGE		

E.

CAPCO KIN 0000372

001534

STATEMENT OF REMITTANCE

CEMENT ASBESTOS PRODUCTS COMPANY

WOODWARD, ALABAMA

ACCEPTANCE OF THIS CHECK WILL BE CONSIDERED FULL PAYMENT OF ITEMS LISTED ON THIS VOUCHER

DATE OF INVOICE	DIV.	AMOUNT	DISCOUNT	NET
01/27		13,58739		13,58739

CAPCO KIN 0000373

APPROVED	MO	DAY	YR.	TOTAL	VENDOR
[illegible]	02	10	66	13,58739	NORTH AMER ASBESTOS CORP

DETACH AND RETAIN FOR YOUR FILE

CONTINUOUS INTERLEAVED® MOORE BUSINESS FORMS, INC. BU

NORTH AMERICAN ASBESTOS CORPORATION

141 WEST JACKSON BOULEVARD • CHICAGO 4, ILLINOIS

TELEPHONE WABASH 2-1338

FEB 2 1966

INVOICE No. 4833

DATE January 27, 1966

CUSTOMER ORDER NO. RM-12

OUR ORDER NO. 4143

SOLD TO

Cement Asbestos Products Company

Woodward, Alabama 35189

SHIPPED TO

Cement Asbestos Products Co.
Ragland, Alabama

ss "Norman Lykes" to Port of Mobile

SHIPPED VIA L&N - SAL Delivery

SHIPPING DATE January 12, 1966

QUANTITY	DESCRIPTION	PRICE	TOTAL
59.95 tons (1199 bags)	Grade S Blue Fiber	@ $201.60 per ton f.o.b. African Port	$12,085.92
	Ocean Freight - Durban/Mobile		1,501.47
			$13,587.39
	Car No. Milw. 37148 - 509 bags Car No. SLSF 18186 - 470 bags Car No. SP 131643-220 bags		
	Order Shipped Complete 1-21-66		
	Terms: Net 10 Days		

REGISTER 3280
INVOICE DATE 01 27
DATE TO BE PAID 02 10
LIST NO. 90201
G/L ACCT. a6
INVOICE AMT. 13 587.39

CAPCO KIN 0000374

Mobile, Ala., JANUARY 18 19 66

CEMENT ASBESTOS PRODUCTS COMPANY

EX: NAAC

FM 12

IN ACCOUNT WITH

N. D. CUNNINGHAM & CO., INC.

EX: NORMAN LYKES REF: 1200 BAGS CRUDE ASBESTOS

TO: CEMENT ASBESTOS PRODUCTS CO. REFUND O/FRT	1501	47
CONSUMPTION ENTRY	15	00
CARRIERS RELEASE CERTIFICATE	1	50
BOND CHARGES	3	00
DELIVERY ORDERS & FORWARDING 3 CARS 5.00 EA	15	00
MESSENGER SERVICE	2	00
TOTAL	1537	97
LESS OCEAN FREIGHT ADVANCED	1501	47
TOTAL BALANCE DUE	36	50

PLEASE FIND ATTACHED OUR CHECK NUMBER 37014, DATED 1/18/66 YOUR ORDER FOR THE ABOVE OCEAN FREIGHT AS NAAC ADVANCED THE CHARGES.

DATE MATERIAL RECEIVED 1-19-66

CHARGE 53-2 (9-5)

APPROVED—STOREKEEPER

FEDERAL MARITIME COMMISSION FREIGHT FORWARDERS APPLICATION NO. 142

CAPCO KIN 0000375

5M Sets—12-64 Form 3570

(Uniform Domestic Straight Bill of Lading, adopted by Carriers in Official, Southern, Western and Illinois Classification Territories, March 15, 1922, as amended August 1, 1930 and June 15, 1941.) 1st SHEET

UNIFORM STRAIGHT BILL OF LADING

Shipper's No. _____

ORIGINAL—NOT NEGOTIABLE

Agent's No. _____

L&N

Louisville & Nashville Railroad Company

RECEIVED, subject to the classifications and tariffs in effect on the date of the issue of this Bill of Lading, 12TH

at SOUTH C, A.S.D. MOBILE, ALABAMA JANUARY ~~XX~~, 19 66

from NORTH AMERICAN ASBESTOS CORP. BOARD OF TRADE BUILDING CHICAGO, ILLINOIS

the property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below, which said company (the word company being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its own road or its own water line, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the conditions not prohibited by law, whether printed or written, herein contained, including the conditions on back hereof, which are hereby agreed to by the shipper and accepted for himself and his assigns.

(Mail or street address of consignee—For purposes of notification only.)

Consigned to CEMENT ASBESTOS PRODUCTS CO. RAGLAND ALABAMA

Destination RAGLAND, State of ALABAMA County of _____

Route L & N, B[illegible]

Delivering Carrier SAL Car Initial SEE Car No. BELOW

No. Packages	DESCRIPTION OF ARTICLES, SPECIAL MARKS, AND EXCEPTIONS	*WEIGHT (Subject to Correction)	CLASS OR RATE	CHECK COLUMN
1199	BAGS-BLUE ASBESTOS (CRUDE)	~~XXXXXXX~~ 123100		
	Cape S Blue	RM 12		
	EX: NORMAN LYKES, B/L 1, DURBAN			
	PIER: SOUTH C			
	MKD: 'S'			
509	BAGS LOADED IN MILW 37148 G 96100 T 43800 NET 52300			
	SEALS / 130475 & 130492			
	EXCEPTIONS / 11 SACKS TORN CONTENTS EXPOSED			
470	BAGS LOADED IN SLSF 18186 G 95700 T 47900 NET 47800			
	SEALS / 130490/91			
	EXCEPTIONS / 11 SACKS TORN CONTENTS EXPOSED			
220	BAGS LOADED IN SP 131643 TRAILER CAR G 68300 T 45300 NET 23000			
	SEALS / 130645/46			
	EXCEPTIONS / 10 SACKS TORN WITH SMALL HOLES			

Subject to Section 7 of conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:

The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

(Signature of Consignor.)

If charges are to be prepaid, write or stamp here, "To be Prepaid."

COLLECT

Received $ _____ to apply in prepayment of the charges on the property described hereon.

Agent or Cashier.

Per _____

(The signature here acknowledges only the amount prepaid.)

Charges Advanced:

*If the shipment moves between two ports by a carrier by water, the law requires that the bill of lading shall state whether it is "carrier's or shipper's weight."

NOTE—Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.

The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding _____ per _____

RECEIVED JAN 12 1966 L&N R.R. CO. LOCAL FREIGHT OFFICE MOBILE, ALA.

N.D. CUNNINGHAM AND COMPANY Shipper. L E BROWN Agent

Per [signature] Per HWE

Permanent postoffice address of Shipper P.O. BOX 15, MOBILE, ALABAMA

CAPCO KIN 0000376

CONTRACT TERMS AND CONDITIONS

Sec. 1. (a) The carrier or party in possession of any of the property herein described shall be liable as at common law for any loss thereof or damage thereto, except as hereinafter provided.

(b) No carrier or party in possession of all or any of the property herein described shall be liable for any loss thereof or damage thereto or delay caused by the act of God, the public enemy, the authority of law or the act or default of the shipper or owner, or for natural shrinkage. The carrier's liability shall be that of warehouseman, only, for loss, damage, or delay caused by fire occurring after the expiration of the free time allowed by tariffs lawfully on file (such free time to be computed as therein provided) after notice of the arrival of the property at destination or at the port of export (if intended for export) has been duly sent or given, and after placement of the property for delivery at destination, or tender of delivery of the property to the party entitled to receive it, has been made. Except in case of negligence of the carrier or party in possession (and the burden to prove freedom from such negligence shall be on the carrier or party in possession), the carrier or party in possession shall not be liable for loss, damage, or delay occurring while the property is stopped and held in transit upon the request of the shipper, owner, or party, entitled to make such request, or resulting from a defect or vice in the property, or for country damage to cotton, or from riots or strikes.

(c) In case of quarantine the property may be discharged at risk and expense of owners into quarantine depot or elsewhere, as required by quarantine regulations or authorities, or for the carrier's dispatch at nearest available point in carrier's judgment, and in any such case carrier's responsibility shall cease when property is so discharged, or property may be returned by carrier at owner's expense to shipping point, carrying freight both ways. Quarantine expenses of whatever nature or kind upon or in respect to property shall be borne by the owners of the property or be a lien thereon. The carrier shall not be liable for loss or damage occasioned by fumigation or disinfection or other acts required or done by quarantine regulations or authorities even though the same may have been done by carrier's officers, agents, or employees, nor for detention, loss, or damage of any kind occasioned by quarantine or the enforcement thereof. No carrier shall be liable, except in case of negligence, for any mistake or inaccuracy in any information furnished by the carrier, its agents, or officers, as to quarantine laws or regulations. The shippers shall hold the carriers harmless from any expense they may incur, or damages they may be required to pay, by reason of the introduction of the property covered by this contract into any place against the quarantine laws or regulations in effect at such place.

Sec. 2. (a) No carrier is bound to transport said property by any particular train or vessel, or in time for any particular market or otherwise than with reasonable dispatch. Every carrier shall have the right in case of physical necessity to forward said property by any carrier or route between the point of shipment and the point of destination. In all cases not prohibited by law, where a lower value than actual value has been represented in writing by the shipper or has been agreed upon in writing as the released value of the property as determined by the classification or tariffs upon which the rate is based, such lower value plus freight charges if paid shall be the maximum amount to be recovered, whether or not such loss or damage occurs from negligence.

(b) As a condition precedent to recovery, claims must be filed in writing with the receiving or delivering carrier, or carrier issuing this bill of lading, or carrier on whose line the loss, damage, injury or delay occurred, within nine months after delivery of the property (or, in case of export traffic, within nine months after delivery at port of export) or, in case of failure to make delivery, then within nine months after a reasonable time for delivery has elapsed; and suits shall be instituted against any carrier only within two years and one day from the day when notice in writing is given by the carrier to the claimant that the carrier has disallowed the claim or any part or parts thereof specified in the notice. Where claims are not filed or suits are not instituted thereon in accordance with the foregoing provisions, no carrier hereunder shall be liable, and such claims will not be paid.

(c) Any carrier or party liable on account of loss of or damage to any of said property shall have the full benefit of any insurance that may have been effected upon or on account of said property, so far as this shall not avoid the policies or contracts of insurance: Provided, That the carrier reimburse the claimant for the premium paid thereon.

Sec. 3. Except where such service is required as the result of carrier's negligence, all property shall be subject to necessary cooperage and baling at owner's cost. Each carrier over whose route cotton or cotton linters is to be transported hereunder shall have the privilege, at its own cost and risk, of compressing the same for greater convenience in handling or forwarding, and shall not be held responsible for deviation or unavoidable delays in procuring such compression. Grain in bulk consigned to a point where there is a railroad, public or licensed elevator, may (unless otherwise expressly noted herein, and then if it is not promptly unloaded) be there delivered and placed with other grain of the same kind and grade without respect to ownership (and prompt notice thereof shall be given to the consignor), and if so delivered shall be subject to a lien for elevator charges in addition to all other charges hereunder.

Sec. 4. (a) Property not removed by the party entitled to receive it within the free time allowed by tariffs, lawfully on file (such free time to be computed as therein provided), after notice of the arrival of the property at destination or at the port of export (if intended for export) has been duly sent or given, and after placement of the property for delivery at destination has been made, may be kept in vessel, car, depot, warehouse or place of delivery of the carrier, subject to the tariff charge for storage and to carrier's responsibility as warehouseman, only, or at the option of the carrier, may be removed to and stored in a public or licensed warehouse at the place of delivery or other available place, at the cost of the owner, and there held without liability on the part of the carrier, and subject to a lien for all freight and other lawful charges, including a reasonable charge for storage.

(b) Where nonperishable property which has been transported to destination hereunder is refused by consignee or the party entitled to receive it, or said consignee or party entitled to receive it fails to receive it within 15 days after notice of arrival shall have been duly sent or given, the carrier may sell the same at public auction to the highest bidder, at such place as may be designated by the carrier: Provided, That the carrier shall have first mailed, sent, or given to the consignor notice that the property has been refused or remains unclaimed, as the case may be, and that it will be subject to sale under the terms of the bill of lading if disposition be not arranged for, and shall have published notice containing a description of the property, the name of the party to whom consigned, or, if shipped order notify, the name of the party to be notified, and the time and place of sale, once a week for two successive weeks, in a newspaper of general circulation at the place of sale or nearest place where such newspaper is published: Provided, That 30 days shall have elapsed before publication of notice of sale after said notice that the property was refused or remains unclaimed was mailed, sent, or given.

(c) Where perishable property which has been transported hereunder to destination is refused by consignee or party entitled to receive it, or said consignee or party entitled to receive it shall fail to receive it promptly, the carrier may, in its discretion, to prevent deterioration or further deterioration, sell the same to the best advantage at private or public sale: Provided, That if time serves for notification to the consignor or owner of the refusal of the property or the failure to receive it and request for disposition of the property, such notification shall be given, in such manner as the exercise of due diligence requires, before the property is sold.

(d) Where the procedure provided for in the two paragraphs last preceding is not possible, it is agreed that nothing contained in said paragraphs shall be construed to abridge the right of the carrier at its option to sell the property under such circumstances and in such manner as may be authorized by law.

(e) The proceeds of any sale made under this section shall be applied by the carrier to the payment of freight, demurrage, storage, and any other lawful charges and the expense of notice, advertisement, sale, and other necessary expenditure of caring for and maintaining the property. If proper care of the same requires special expense, and should there be a balance it shall be paid to the owner of the property sold hereunder.

(f) Property destined to or taken from a station, wharf, or landing at which there is no regularly appointed freight agent shall be entirely at risk of owner after unloaded from cars or vessels or until loaded into cars or vessels, and, except in case of carrier's negligence, when received from or delivered to such stations, wharves, or landings shall be at owner's risk until the cars are attached to and after they are detached from locomotive or train or until loaded into and after unloaded from vessels.

Sec. 5. No carrier hereunder will carry or be liable in any way for any documents, specie, or for any articles of extraordinary value not specifically rated in the published classifications or tariffs unless a special agreement to do so and a stipulated value of the articles are indorsed hereon.

Sec. 6. Every party, whether principal or agent, shipping explosives or dangerous goods, without previous full written disclosure to the carrier of their nature, shall be liable for and indemnify the carrier against all loss or damage caused by such goods, and such goods may be warehoused at owner's risk and expense or destroyed without compensation.

Sec. 7. The owner or consignee shall pay the freight and average, if any, and all other lawful charges accruing on said property; but, except in those instances where it may lawfully be authorized to do so, no carrier by railroad shall deliver or relinquish possession at destination of the property covered by this bill of lading until all tariff rates and charges thereon have been paid. The consignor shall be liable for the freight and all other lawful charges, except that if the consignor stipulates, by signature, in the space provided for that purpose on the face of this bill of lading that the carrier shall not make delivery without requiring payment of such charges and the carrier, contrary to such stipulation, shall make delivery without requiring such payment, the consignor (except as hereinafter provided) shall not be liable for such charges. Provided, that, where the carrier has been instructed by the shipper or consignor to deliver said property to a consignee other than the shipper or consignor, such consignee shall not be legally liable for transportation charges in respect of the transportation of said property (beyond those billed against him at the time of delivery for which he is otherwise liable) which may be found to be due after the property has been delivered to him, if the consignee (a) is an agent only and has no beneficial title in said property, and (b) prior to delivery of said property has notified the delivering carrier in writing of the fact of such agency and absence of beneficial title, and, in the case of a shipment reconsigned or diverted to a point other than that specified in the original bill of lading, has also notified the delivering carrier in writing of the name and address of the beneficial owner of said property; and, in such cases the shipper or consignor, or, in the case of a shipment so reconsigned or diverted, the beneficial owner, shall be liable for such additional charges. If the consignee has given to the carrier erroneous information as to who the beneficial owner is, such consignee shall himself be liable for such additional charges. On shipments reconsigned or diverted by an agent who has furnished the carrier in the reconsignment or diversion order with a notice of agency and the proper name and address of the beneficial owner, if such shipments are refused or abandoned at ultimate destination, the said beneficial owner shall be liable for all legally applicable charges in connection therewith. If the reconsignor or diverter has given to the carrier erroneous information as to who the beneficial owner is, such reconsignor or diverter shall himself be liable for all such charges.

If a shipper or consignor of a shipment of property (other than a prepaid shipment) is also the consignee named in the bill of lading and, prior to the time of delivery, notifies, in writing, a delivering carrier by railroad (a) to deliver such property at destination to another party, (b) that such party is the beneficial owner of such property, and (c) that delivery is to be made to such party only upon payment of all transportation charges in respect of the transportation of such property, and delivery is made by the carrier to such party without such payment, such carrier shall be liable to the shipper, consignor, consignee, or otherwise) for such transportation charges but the party to whom delivery is so made shall in any event be liable for transportation charges billed against the property at the time of such delivery, and also for any additional charges which may be found to be due after delivery of the property, except that if such party prior to such delivery has notified in writing the delivering carrier that he is not the beneficial owner of the property, and has given in writing to such delivering carrier the name and address of such beneficial owner, such party shall not be liable for any additional charges which may be found to be due after delivery of the property; but if the party to whom delivery is made has given to the carrier erroneous information as to the beneficial ownership, such party shall nevertheless be liable for such additional charges. If the shipper or consignor has given to the delivering carrier erroneous information as to who the beneficial owner is, such shipper or consignor shall himself be liable for such transportation charges, notwithstanding the foregoing provisions of this paragraph and irrespective of any provisions to the contrary in the bill of lading or in the contract of transportation under which the shipment was made. The term "delivering carrier" means the line-haul carrier making ultimate delivery.

Nothing herein shall limit the right of the carrier to require at time of shipment the prepayment or guarantee of the charges. If upon inspection it is ascertained that the articles shipped are not those described in this bill of lading, the freight charges must be paid upon the articles actually shipped.

Where delivery is made by a common carrier by water the foregoing provisions of this section shall apply, except as may be inconsistent with Part III of the Interstate Commerce Act.

Sec. 8. If this bill of lading is issued on the order of the shipper, or his agent, in exchange or in substitution for another bill of lading, the shipper's signature to the prior bill of lading as to the statement of value or otherwise, or election of common law or bill of lading liability, in or in connection with such prior bill of lading shall be considered a part of this bill of lading as fully as if the same were written or made in or in connection with this bill of lading.

Sec. 9. (a) If all or any part of said property is carried by water over any part of said route, and loss, damage or injury to said property occurs while the same is in the custody of a carrier by water, the liability of such carrier shall be determined by the bill of lading of the carrier by water (this bill of lading being such bill of lading if the property is transported by such water carrier thereunder) and by and under the laws and regulations applicable to transportation by water. Such water carriage shall be performed subject to all the terms and provisions of, and all the exemptions from liability contained in the Act of the Congress of the United States, approved on February 13, 1893, and entitled "An act relating to the navigation of vessels, etc.," and of other statutes of the United States according carriers by water the protection of limited liability, as well as the following subdivisions of this section; and to the conditions contained in this bill of lading not inconsistent with this section, when this bill of lading becomes the bill of lading of the carrier by water.

(b) No such carrier by water shall be liable for any loss or damage resulting from any fire happening to or on board the vessel, or from explosion, bursting of boilers or breakage of shafts, unless caused by the design or neglect of such carrier;

(c) If the owner shall have exercised due diligence in making the vessel in all respects seaworthy and properly manned, equipped, and supplied, no such carrier shall be liable for any loss or damage resulting from the perils of the lakes, seas, or other waters, or from latent defects in hull, machinery, or appurtenances whether existing prior to, at the time of, or after sailing, or from collision, stranding, or other accidents of navigation, or from prolongation of the voyage. And, when for any reason it is necessary, any vessel carrying any or all of the property described in this bill of lading shall be at liberty to call at any port or ports, in or out of the customary route, to tow and be towed, to transfer, trans-ship, or lighter, to load and discharge goods at any time, to assist vessels in distress, to deviate for the purpose of saving life or property, and for docking and repairs. Except in case of negligence such carrier shall not be responsible for any loss or damage to property if it be necessary or is usual to carry the same upon deck.

(d) General Average shall be payable according to the York-Antwerp Rules of 1924, Sections 1 to 15, inclusive, and Sections 17 to 22, inclusive, and as to matters not covered thereby according to the laws and usages of the Port of New York. If the owners shall have exercised due diligence to make the vessel in all respects seaworthy and properly manned, equipped and supplied, it is hereby agreed that in case of danger, damage or disaster resulting from faults or errors in navigation, or in the management of the vessel, or from any latent or other defects in the vessel, her machinery or appurtenances, or from unseaworthiness, whether existing at the time of shipment or at the beginning of the voyage (provided the latent or other defects or the unseaworthiness was not discoverable by the exercise of due diligence), the shippers, consignees and/or owners of the cargo shall nevertheless pay salvage and any special charges incurred in respect of the cargo, and shall contribute with the shipowner in general average to the payment of any sacrifices, losses or expenses of a general average nature that may be made or incurred for the common benefit or to relieve the adventure from any common peril.

(e) If the property is being carried under a tariff which provides that any carrier or carriers party thereto shall be liable for loss from perils of the sea, then as to such carrier or carriers the provisions of this section shall be modified in accordance with the tariff provisions, which shall be regarded as incorporated into the conditions of this bill of lading.

(f) The term "water carriage" in this section shall not be construed as including lighterage in or across rivers, harbors, or lakes, when performed by or on behalf of rail carriers.

Sec. 10. Any alteration, addition, or erasure in this bill of lading which shall be made without the special notation hereon of the agent of the carrier issuing this bill of lading, shall be without effect, and this bill of lading shall be enforceable according to its original tenor.

CAPCO KIN 0000377

N. D. CUNNINGHAM & CO., INC.
FORWARDERS & CUSTOMS BROKERS
MOBILE, ALA.

PRO FORMA CLAIM
OVER, SHORT OR DAMAGED
CARGO REPORT

JANUARY 18, 1966

S/S HORMAN LYKES

LYKES BROS. STEAMSHIP CO.
P.O. BOX 1051
MOBILE, ALABAMA

YOU ARE HEREBY NOTIFIED OF THE DISCREPANCY IN SHIPMENT AS INDICATED BELOW:

SHIPPER NAMED ON B/L ?

ORIGIN SOUTH AFRICA EXIT PORT DURBAN

DEL. CARRIER HORMAN LYKES ULT. DEST. MOBILE

FOR ACCOUNT OF CEMENT ASBESTOS PRODUCTS CO. RAGLAND, ALABAMA

CAR NUMBER GILW 37148, SLSF 13186, SP131643,

COMMODITY 1200 BAGS CRUDE ASBESTOS

MARKED NS

CLAIM, CAR NO. GILW37148, 11 SACKS TORN CONTENTS EXPOSED, SLSF 13186, 11 SACKS TORN, CONTENTS EXPOSED, SP131643, 10 SACKS TORN WITH SMALL HOLES

REMARKS DAMAGED NOTED BY INLAND CARRIER AT TIME OF PICKUP

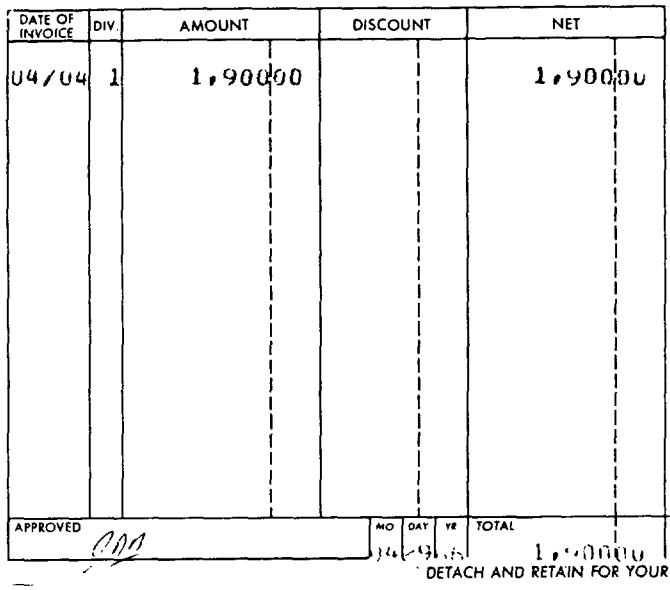
I CERTIFY that this Report is Correct. In my opinion the OCEAN CARRIER is liable.

Meanwhile on behalf of our Principals we hold you Fully Liable and Reserve Right to File Claim at a Future Date.

N. D. CUNNINGHAM & CO., INC.

BY:

CAPCO KIN 0000378



DATE OF INVOICE	DIV.	AMOUNT	DISCOUNT	NET
04/04	1	1,900.00		1,900.00

APPROVED

MO | DAY | YR

TOTAL 1,900.00

VENDOR

DETACH AND RETAIN FOR YOUR FILE

COPYRIGHT MOORE BUSINESS FORMS, INC. BU

CONTINUOUS INTERLEAVED®

001933

STATEMENT OF REMITTANCE

CEMENT ASBESTOS PRODUCTS COMPANY

WOODWARD, ALABAMA

ACCEPTANCE OF THIS CHECK WILL BE CONSIDERED FULL PAYMENT OF ITEMS LISTED ON THIS VOUCHER.

CAPCO KIN 0000379

APR 1 1966 APR 1 1966

NORTH AMERICAN ASBESTOS CORPORATION

141 WEST JACKSON BOULEVARD • CHICAGO 4, ILLINOIS

TELEPHONE WABASH 2-1338

INVOICE No. 4953

DATE April 7, 1966

SOLD TO

Cement Asbestos Products

Ragland, Alabama

CUSTOMER ORDER NO. RM18

OUR ORDER NO. 4265

SHIPPED TO

Same

Akers to Atlanta

SHIPPED VIA c/o Alabama Highway Express SHIPPING DATE April 4, 1966

QUANTITY	DESCRIPTION	PRICE	TOTAL
10 tons (20,000 lbs.)	Grade S33 Amosite Fiber Order Shipped Complete Terms: Net 10 Days	@ $190.00 per ton f.o.b. whse. Philadelphia	$1,900.00

REGISTER 2456
INVOICE DATE 0404
DATE TO BE PAID 0429
LIST PRICE 10402
C's ACCT. Ab
INVOICE AMT. 1900.00
DISCOUNT
TYPE DISC.

CAPCO KIN 0000380

DON'T GUESS - - SHIP

IRREGULAR ROUTE COMMON CARRIER
GENERAL OFFICES
3300 5TH AVE., SO.
BIRMINGHAM, ALABAMA
TELEPHONE FA 3-5821

Alabama HIGHWAY EXPRESS INC.

ORIG. TERMINAL

PRO. 176322

SHIPPER'S B/L NO. | B/L DATE | DATE BILLED 4-6-66 RM

I.C.C. 71516

FROM: NORTH AMER. ASBESTOS CORP., PHILA, PA.

TO: CEMENT ASBESTOS PROD. AKERS % ALA HIWAY EXP. [illegible], ALA

APSC 721

TRAILER

TRK

WAYBILL DATES, NUMBERS AND POINTS OF TRANSFER OF ALL PREVIOUS CARRIERS (I.C.C. RULING)

MURDOCK 159) (SEAL 505)

NO PIECES	DESCRIPTION, MARKS AND EXCEPTIONS	WEIGHT	RATE	CHARGES
200	BAGS NET EA GRADE S 33 ASBESTOS FIBER 20200 AS	24000	176	422 40 COLL
	CRUDE ASBESTOS FIBER SHOW ON DELY NBOX PAPERS CUTS ORD RM 18			

TERMINALS: AKRON, OHIO; ANNISTON, ALA.; ATLANTA, GA.; BIRMINGHAM, ALA.; CHICAGO, ILL.; CINCINNATI, OHIO; COLUMBUS, OHIO; DAYTON, OHIO; GADSDEN, ALA.; LOUISVILLE, KY.; MEMPHIS, TENN.; PENSACOLA, FLA.; PEORIA, ILL.; TAMPA, FLA.; TOLEDO, OHIO; TUSCALOOSA, ALA.

DATE MATERIAL RECEIVED 4-11-66

CHARGE 53-2 (9-5H)

APPROVED—STOREKEEPER [illegible]

I.C.C. REGULATIONS REQUIRE PAYMENT OF THIS BILL

DR.

AHE BEY'D

RECEIVED IN GOOD CONDITION, EXCEPT AS NOTED

FIRM

DATE

murdock 159

CAPCO KIN 0000381

DATE OF INVOICE	DIV.	AMOUNT	DISCOUNT	NET
07/27	1	15,863.40		15,863.40

002482

STATEMENT OF REMITTANCE

CEMENT ASBESTOS PRODUCTS COMPANY

WOODWARD, ALABAMA

ACCEPTANCE OF THIS CHECK WILL BE CONSIDERED FULL PAYMENT OF ITEMS LISTED ON THIS VOUCHER.

CAPCO KIN 0000382

APPROVED

MO	DAY	YR.	TOTAL	VENDOR
08	10	06	15,863.40	NORTH AMER ASBESTOS CORP.

DETACH AND RETAIN FOR YOUR FILE

CONTINUOUS INTERLEAVED® MOORE BUSINESS FORMS, INC. BU

JUL 29 1966

NORTH AMERICAN ASBESTOS CORPORATION

141 WEST JACKSON BOULEVARD • CHICAGO 4, ILLINOIS

TELEPHONE WABASH 2-12 38

INVOICE No. 5115

1/29 Mobile, Ala
HKS

DATE July 27, 1966

SOLD TO

Cement Asbestos Product s Company
Woodward, Alabama 35189

CUSTOMER ORDER NO. RM-21

OUR ORDER NO. 4382

SHIPPED TO

Cement Asbestos Products
Ragland, Alabama

SHIPPED VIA L & N Railroad

SHIPPING DATE July 15, 1966

QUANTITY	DESCRIPTION	PRICE	TOTAL
70 tons (1400 bags)	Opened S Blue Fiber	@ $201.60 per ton f. o. b. Mobile, Alabama	$14,112.00
	Plus Ocean Freight - South Africa to Mobile		1,751.40
			$15,863.40
	Order Shipped Complete		
	Terms: Net 10 Days		

REGISTER 2853
INVOICE DATE 0727
DATE TO BE PAID 0810
LIST NO. 10801
G-L ACCT. 46
INVOICE AMT. 15,863.40
DISCOUNT
TYPE DISC.

EXEMPT FROM ALABAMA SALES OR USE TAX

CAPCO KIN 0000383

ARRIVAL NOTICE AND COPY OF BILL FOR PAYMENT OF FREIGHT CHARGES

FORM 7 - A

TO SEABOARD AIR LINE RAILROAD COMPANY, HAS RECEIVED THE FOLLOWING ARTICLES CONSIGNED TO YOU

CONSIGNEE Cement Asbestos Products Co. STATION 3305 Ragland Alabama 7-27-19 66

ROUTE I&N BHAM SAL FREIGHT BILL NO. 569

(POINT OF ORIGIN TO DESTINATION)

WAYBILLED FROM	WAYBILL DATE AND NUMBER	FULL NAME OF SHIPPER	CAR INITIAL AND NUMBER
Mobil e Alabamax	7-18-66 128140	N D Cunningham	SEE Below
POINT AND DATE OF SHIPMENT	CONNECTING LINE REFERENCE	PREVIOUS WAYBILL REFERENCE	ORIGINAL CAR INITIAL AND NUMBER

WEIGHED AT GROSS TARE NET 21

TOFC PLAN TRAILER

NUMBER OF PACKAGES, ARTICLES AND MARKS	WEIGHT	RATE	FREIGHT	ADVANCES	TOTAL
1400 Bags Crude Asbestos EX James McKay B/L 4 Durban IC 42914 WT 124400-57500-66900 Exceptions 17 Bags Have Small Holes Torn In Bags Conts Sifting Slightly SOOL 176414 WT 118500-52600-65900 Exceptions 11 Bags Have Small Holes Torn In Bags Conts Sifting Slightly RI 25020 WT 52800-43200-9600	142400	88	1253.12		1253.12

DATE MAT. RECEIVED 2-28-66 (9-5)

CHARGE 53-2

APPROVED [illegible]

VIA [illegible] 569

The above shipment to your consignment has arrived at this station, and is ready for delivery. Unless unloaded or removed within free period allowed by published rules, same will be subject to demurrage or storage charges, as provided for in said rules. Unless this shipment is removed promptly it will be subject to sale as provided in the terms of the bill of lading.

Please deliver this consignment to bearer.

Consignee

Thank You-Your Business is Appreciated

MAKE CHECK PAYABLE TO SEABOARD AIR LINE RAILROAD COMPANY

CAPCO KIN 0000384

002898

STATEMENT OF REMITTANCE

CEMENT ASBESTOS PRODUCTS COMPANY

WOODWARD, ALABAMA

ACCEPTANCE OF THIS CHECK WILL BE CONSIDERED FULL PAYMENT OF ITEMS LISTED ON THIS VOUCHER.

DATE OF INVOICE	DIV	AMOUNT	DISCOUNT	NET
09/28	1	16,917.18		16,917.18

APPROVED

MO. DAY YR

TOTAL 16,917.18

VENDOR NORTH AMER ASBESTOS CORP

DETACH AND RETAIN FOR YOUR FILE

CAPCO KIN 0000385

CONTINUOUS INTERLEAVED® MOORE BUSINESS FORMS, INC. 8U

OCT 7 1966

NORTH AMERICAN ASBESTOS CORPORATION

141 WEST JACKSON BOULEVARD • CHICAGO 4, ILLINOIS

TELEPHONE WABASH 2-1338

OCT 10 1966

INVOICE No. 5202

DATE September 28, 1966

SOLD TO

Cement Asbestos Products Company

Woodward, Alabama

CUSTOMER ORDER NO. RM-25

OUR ORDER NO. 4446

SHIPPED TO

Cement Asbestos Products
Ragland, Alabama

SHIPPED VIA L&N RR - Bham - SAL Delivery SHIPPING DATE September 21, 1966

QUANTITY	DESCRIPTION	PRICE	TOTAL
74.65 tons (1493 bags)	Opened S Blue Fiber	@ $201.60 per ton f.o.b. Mobile, Alabama	$15,049.44
	Plus Ocean Freight - South Africa to Mobile		1,867.74
			$16,917.18
	Order Shipped Complete		
	Terms: Net Ten Days		

REGISTER 4252
INVOICE DATE 09 28
DATE TO BE PAID 10 25
LIFT NO. 110 02
G L ACCT. 06
INVOICE AMT. 16,917.18
DISCOUNT
TYPE DISC.

CAPCO KIN 0000386

ARRIVAL NOTICE AND COPY OF BILL FOR PAYMENT OF FREIGHT CHARGES

FORM 7-A

TO SEABOARD AIR LINE RAILROAD COMPANY, HAS RECEIVED THE FOLLOWING ARTICLES CONSIGNED TO YOU

Pagland, Ala. STATION Oct 4, 1966 19

CONSIGNEE Cement Asbestos Products Co. FREIGHT BILL NO. 24

ROUTE (POINT OF ORIGIN TO DESTINATION) L&N Bham SAL

WAYBILLED FROM	WAYBILL DATE AND NUMBER	FULL NAME OF SHIPPER	CAR INITIAL AND NUMBER
Mobile, Ala.	9-21-66 122168	M. D. Cunningham Co.	(see below)
POINT AND DATE OF SHIPMENT	CONNECTING LINE REFERENCE	PREVIOUS WAYBILL REFERENCE	ORIGINAL CAR INITIAL AND NUMBER

WEIGHED AT TRR State Docks, Mobile, Ala. GROSS TARE NET

NUMBER OF PACKAGES, ARTICLES AND MARKS	WEIGHT	RATE	FREIGHT	ADVANCES	TOTAL
~~1543~~ 1493 ~~bags~~ crude asbestos (3 cars)	153100	.88	1347.28		1347.28

# Bags	CAR NUMBER	GROSS	TARE	NET
683	MP 89313	124000	54100	69900
600	MILW 52073	123100	61500	61600
210	CNW 24821	68700	47100	21600 Trailer car.

1493 —

10-1-66 (9-5) AB

53-2

The above shipment to your consignment has arrived at this station, and is ready for delivery. Unless unloaded or removed within free period allowed by published rules, same will be subject to demurrage or storage charges, as provided for in said rules. Unless this shipment is removed promptly it will be subject to sale as provided in the terms of the bill of lading.

Please deliver this consignment to bearer.

Consignee

Thank You-Your Business is Appreciated

MAKE CHECK PAYABLE TO SEABOARD AIR LINE RAILROAD COMPANY

CAPCO KIN 0000387

004078

STATEMENT OF REMITTANCE

CEMENT ASBESTOS PRODUCTS COMPANY

WOODWARD, ALABAMA

ACCEPTANCE OF THIS CHECK WILL BE CONSIDERED FULL PAYMENT OF ITEMS LISTED ON THIS VOUCHER.

DATE OF INVOICE	DIV.	AMOUNT	DISCOUNT	NET
4/11	1	23,415 00		23,415 00

CAPCO KIN 0000388

APPROVED	MO.	DAY	YR	TOTAL	VENDOR
[illegible]	[illegible]	25	67	23,415 00	[illegible]

DETACH AND RETAIN FOR YOUR FILE

CONTINUOUS INTERLEAVED® MOORE BUSINESS FORMS, INC. BU

APR 1 1967

APR 14 1967

NORTH AMERICAN ASBESTOS CORPORATION

200 SOUTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60604

TELEPHONE (312) 922-7435

INVOICE Nº 5427

DATE April 11, 1967

CUSTOMER ORDER NO. RM-37

OUR ORDER NO. 1973

SOLD TO

Cement Asbestos Company

Woodward, Alabama

ss "Musi Lloyd" to Port of Mobile

SHIPPED TO

Cement Asbestos Company
Ragland, Alabama
Attn: W. H. Beasley

SHIPPED VIA Rail freight to your plant

SHIPPING DATE April 3, 1967

QUANTITY	DESCRIPTION	PRICE	TOTAL
105 tons (2,100 bags)	— Grade OWS Blue Fiber	4/14 S.P. @ $223.00 per ton f.o.b. Port of Mobile	$23,415.00

REGISTER 2782
INVOICE DATE 04 11
DATE TO BE PAID 04 25
LIST NO 10402
OIL ACCT ab
INVOICE AMT 23,415.00
DISCOUNT
TYPE DISC.

First Partial Shipment

Terms: Net Ten Days

Sal

PJ. apr.

340 2,101.02

4-13-67 D. Crack

9-5

2

AB

W. W. Jemison

CAPCO KIN 000038

30M Bots - 4-61 Form 3570

(Uniform Domestic Straight Bill of Lading, adopted by Carriers in Official, Southern, Western and Illinois Classification Territories, March 15, 1922, as amended August 1, 1930 and June 15, 1941.) 1st SHEET

L&N

UNIFORM STRAIGHT BILL OF LADING

ORIGINAL—NOT NEGOTIABLE

Shipper's No._____

Agent's No._____

Louisville & Nashville Railroad Company

RECEIVED, subject to the classifications and tariffs in effect on the date of the issue of this Bill of Lading,

at NORTH A PIER: 8X A.S.D. MOBILE, ALA. 4/8 5 67, 19__

from NORTH AMERICAN ASBESTOS PRODUCTS CO., CHICAGO, ILL.

the property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below, which said company (the word company being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its own road or its own water line, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the conditions not prohibited by law, whether printed or written, herein contained, including the conditions on back hereof, which are hereby agreed to by the shipper and accepted for himself and his assigns.

Consigned to CEMENT ASBESTOS PRODUCTS CO. (Mail or street address of consignee—For purposes of notification only.) (ORDER NO. RM-37)

Destination RAGLAND, State of ALA. County of

Route L&N-BHAM-SAL

Delivering Carrier_____ Car Initial SEE Car No. BELOW

No. Packages	DESCRIPTION OF ARTICLES, SPECIAL MARKS, AND EXCEPTIONS	*WEIGHT (Subject to Correction)	CLASS OR RATE	CHECK COLUMN
2,100	BAGS CRUDE ASBESTOS	17272000 215600		
	EX: MUSI LLOYD, B/L 3, DURBAN PIER: NO A, A.S.D., MOBILE, ALA. MKD: S PRODUCT OF SOUTH AFRICA	47200		
577	BAGS LOADED IN L&N 4719 G 105400 T XXX NET 58200 SEALS / 144762-63			
573	BAGS LOADED IN GN 27555 G 112300 T 52800 NET 59500 SEALS / 144760-61			
554	BAGS LOADED IN SOU 22970 G 107200 T 50100 NET 57100 SEALS / 144758-59			
396	BAGS LOADED IN C&EI 64083 TRLR CAR G 87800 T 47000 NET 40800 SEALS / 144769-70			

Subject to Section 7 of conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:

The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

(Signature of Consignor.)

If charges are to be prepaid, write or stamp here, "To be Prepaid."

COLLECT

Received $_____ to apply in prepayment of the charges on the property described hereon.

Agent or Cashier.

Per_____

(The signature here acknowledges only the amount prepaid.)

TERMINAL RAILWAY, ALA

If the shipment moves between two ports by a carrier by water, the law requires that the bill of lading shall state whether it is "carrier's or shipper's weight."

NOTE—Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.

The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

_____ per_____

RECEIVED APR 6 1967 L&N R. R. CO. L&N FREIGHT OFFICE MOBILE, ALA.

N. D. CUNNINGHAM AND CO., INC. Shipper. L E BROWN Agent

Per AUTHORIZED Mail Clerk Per HWE

Permanent postoffice address of Shipper P.O. BOX 15, MOBILE, ALA.

CAPCO KIN 0000390

CONTRACT TERMS AND CONDITIONS

Sec. 1. (a) The carrier or party in possession of any of the property herein described shall be liable as at common law for any loss thereof or damage thereto, except as hereinafter provided.

(b) No carrier or party in possession of all or any of the property herein described shall be liable for any loss thereof or damage thereto or delay caused by the act of God, the public enemy, the authority of law, or the act or default of the shipper or owner, or for natural shrinkage. The carrier's liability shall be that of warehouseman, only, for loss, damage, or delay caused by fire occurring after the expiration of the free time allowed by tariffs lawfully on file (such free time to be computed as therein provided) after notice of the arrival of the property at destination or at the port of export (if intended for export) has been duly sent or given, and after placement of the property for delivery at destination, or tender of delivery of the property to the party entitled to receive it, has been made. Except in case of negligence of the carrier or party in possession (and the burden to prove freedom from such negligence shall be on the carrier or party in possession), the carrier or party in possession shall not be liable for loss, damage, or delay occurring while the property is stopped and held in transit upon the request of the shipper, owner, or party entitled to make such request, or resulting from a defect or vice in the property, or for country damage to cotton, or from riots or strikes.

(c) In case of quarantine the property may be discharged at risk and expense of owners into quarantine depot or elsewhere, as required by quarantine regulations or authorities, or for the carrier's dispatch at nearest available point in carrier's judgment, and in any such case carrier's responsibility shall cease when property is so discharged, or property may be returned by carrier at owner's expense to shipping point, earning freight both ways. Quarantine expenses of whatever nature or kind upon or in respect to property shall be borne by the owners of the property or be a lien thereon. The carrier shall not be liable for loss or damage occasioned by fumigation or disinfection or other acts required or done by quarantine regulations or authorities even though the same may have been done by carrier's officers, agents, or employees, nor for detention, loss, or damage of any kind occasioned by quarantine or the enforcement thereof. No carrier shall be liable, except in case of negligence, for any mistake or inaccuracy in any information furnished by the carrier, its agents, or officers, as to quarantine laws or regulations. The shipper shall hold the carriers harmless from any expense they may incur, or damages they may be required to pay, by reason of the introduction of the property covered by this contract into any place against the quarantine laws or regulations in effect at such place.

Sec. 2. (a) No carrier is bound to transport said property by any particular train or vessel, or in time for any particular market or otherwise than with reasonable dispatch. Every carrier shall have the right in case of physical necessity to forward said property by any carrier or route between the point of shipment and the point of destination. In all cases not prohibited by law, where a lower value than actual value has been represented in writing by the shipper or has been agreed upon in writing as the released value of the property as determined by the classification or tariffs upon which the rate is based, such lower value plus freight charges if paid shall be the maximum amount to be recovered, whether or not such loss or damage occurs from negligence.

(b) As a condition precedent to recovery, claims must be filed in writing with the receiving or delivering carrier, or carrier issuing this bill of lading, or carrier on whose line the loss, damage, injury or delay occurred, within nine months after delivery of the property (or, in case of export traffic, within nine months after delivery at port of export) or, in case of failure to make delivery, then within nine months after a reasonable time for delivery has elapsed; and suits shall be instituted against any carrier only within two years and one day from the day when notice in writing is given by the carrier to the claimant that the carrier has disallowed the claim or any part or parts thereof specified in the notice. Where claims are not filed or suits are not instituted thereon in accordance with the foregoing provisions, no carrier hereunder shall be liable, and such claims will not be paid.

(c) Any carrier or party liable on account of loss of or damage to any of said property shall have the full benefit of any insurance that may have been effected upon or on account of said property, so far as this shall not avoid the policies or contracts of insurance: *Provided*, That the carrier reimburse the claimant for the premium paid thereon.

Sec. 3. Except where such service is required as the result of carrier's negligence, all property shall be subject to necessary cooperage and baling at owner's cost. Each carrier over whose route cotton or cotton linters is to be transported hereunder shall have the privilege, at its own cost and risk, of compressing the same for greater convenience in handling or forwarding, and shall not be held responsible for deviation or unavoidable delays in procuring such compression. Grain in bulk consigned to a point where there is a railroad, public or licensed elevator, may (unless otherwise expressly noted herein, and then if it is not promptly unloaded) be there delivered and placed with other grain of the same kind and grade without respect to ownership (and prompt notice thereof shall be given to the consignor), and if so delivered shall be subject to a lien for elevator charges in addition to all other charges hereunder.

Sec. 4 (a) Property not removed by the party entitled to receive it within the free time allowed by tariffs, lawfully on file (such free time to be computed as therein provided), after notice of the arrival of the property at destination or at the port of export (if intended for export) has been duly sent or given, and after placement of the property for delivery at destination has been made, may be kept in vessel, car, depot, warehouse or place of delivery of the carrier, subject to the tariff charge for storage and to carrier's responsibility as warehouseman, only, or at the option of the carrier, may be removed to and stored in a public or licensed warehouse at the place of delivery or other available place, at the cost of the owner, and there held without liability on the part of the carrier, and subject to a lien for all freight and other lawful charges, including a reasonable charge for storage.

(b) Where non-perishable property which has been transported to destination hereunder is refused by consignee or the party entitled to receive it, or said consignee or party entitled to receive it fails to receive it within 15 days after notice of arrival shall have been duly sent or given, the carrier may sell the same at public auction to the highest bidder, at such place as may be designated by the carrier: *Provided*, That the carrier shall have first mailed, sent or given to the consignor notice that the property has been refused or remains unclaimed, as the case may be, and that it will be subject to sale under the terms of the bill of lading if disposition be not arranged for, and shall have published notice containing a description of the property, the name of the party to whom consigned, or, if shipped order notify, the name of the party to be notified, and the time and place of sale, once a week for two successive weeks, in a newspaper of general circulation at the place of sale or nearest place where such newspaper is published: *Provided*, That 30 days shall have elapsed before publication of notice of sale after said notice that the property was refused or remains unclaimed was mailed, sent, or given.

(c) Where perishable property which has been transported hereunder to destination is refused by consignee or party entitled to receive it, or said consignee or party entitled to receive it shall fail to receive it promptly, the carrier may, in its discretion, to prevent deterioration or further deterioration, sell the same to the best advantage at private or public sale: *Provided*, That if time serves for notification to the consignor or owner of the refusal of the property or the failure to receive it and request for disposition of the property, such notification shall be given, in such manner as the exercise of due diligence requires, before the property is sold.

(d) Where the procedure provided for in the two paragraphs last preceding is not possible, it is agreed that nothing contained in said paragraphs shall be construed to abridge the right of the carrier at its option to sell the property under such circumstances and in such manner as may be authorized by law.

(e) The proceeds of any sale made under this section shall be applied by the carrier to the payment of freight, demurrage, storage, and any other lawful charges and the expense of notice, advertisement, sale and other necessary expense and of caring for and maintaining the property, if proper care of the same requires special expense, and should there be a balance it shall be paid to the owner of the property said hereunder.

(f) Property destined to or taken from a station, wharf, or landing at which there is no regularly appointed freight agent shall be entirely at risk of owner after unloaded from cars or vessels or until loaded into cars or vessels, and, except in case of carrier's negligence, when received from or delivered to such stations, wharves, or landings shall be at owner's risk until the cars are attached to and after they are detached from locomotive or train or until loaded into and after unloaded from vessels.

Sec. 5. No carrier hereunder shall issue or be liable in any way for any documents, specie, or for any articles of extraordinary value not specifically rated in the published classifications or tariffs unless a special agreement to do so and a stipulated value of the articles are indorsed hereon.

Sec. 6. Every party, whether principal or agent, shipping explosives or dangerous goods, without previous full written disclosure to the carrier of their nature, shall be liable for and indemnify the carrier against all loss or damage caused by such goods, and such goods may be warehoused at owner's risk and expense or destroyed without compensation.

Sec. 7. The owner or consignee shall pay the freight and average, if any, and all other lawful charges accruing on said property; but, except in those instances where it may lawfully be authorized to do so, no carrier by railroad shall deliver or relinquish possession at destination of the property covered by this bill of lading until all tariff rates and charges thereon have been paid. The consignor shall be liable for the freight and all other lawful charges, except that if the consignor stipulates, by signature, in the space provided for that purpose on the face of this bill of lading that the carrier shall not make delivery without requiring payment of such charges and the carrier, contrary to such stipulation, shall make delivery without requiring such payment, the consignor (except as hereinafter provided) shall not be liable for such charges. *Provided, that*, where the carrier has been instructed by the shipper or consignor to deliver said property to a consignee other than the shipper or consignor, such consignee shall not be legally liable for transportation charges in respect of the transportation of said property (beyond those billed against him at the time of delivery for which he is otherwise liable) which may be found to be due after the property has been delivered to him, if the consignee (*a*) is an agent only and has no beneficial title in said property, and (*b*) prior to delivery of said property has notified the delivering carrier in writing of the fact of such agency and absence of beneficial title, and, in the case of a shipment reconsigned or diverted to a point other than that specified in the original bill of lading, has also notified the delivering carrier in writing of the name and address of the beneficial owner of said property; and, in such cases the shipper or consignor, or, in the case of a shipment so reconsigned or diverted, the beneficial owner, shall be liable for such additional charges. If the consignee has given to the carrier erroneous information as to who the beneficial owner is, such consignee shall himself be liable for such additional charges. On shipments reconsigned or diverted by an agent who has furnished the carrier in the reconsignment or diversion order with a notice of agency and the proper name and address of the beneficial owner, and where such shipments are refused or abandoned at ultimate destination, the said beneficial owner shall be liable for all legally applicable charges in connection therewith. If the reconsignor or diverter has given to the carrier erroneous information as to who the beneficial owner is, such reconsignor or diverter shall himself be liable for all such charges.

If a shipper or consignor of a shipment of property (other than a prepaid shipment) is also the consignee named in the bill of lading and, prior to the time of delivery, notifies, in writing, a delivering carrier by railroad (*a*) to deliver such property at destination to another party, (*b*) that such party is the beneficial owner of such property, and (*c*) that delivery is to be made to such party only upon payment of all transportation charges in respect of the transportation of such property, and delivery is made by *the carrier to such party without such payment, such shipper or consignor shall not be liable (as shipper, consignor, consignee, or otherwise) for such transportation charges* but the party to whom delivery is so made shall in any event be liable for transportation charges billed against the property at the time of such delivery, and also for any additional charges which may be found to be due after delivery of the property, except that if such party prior to such delivery has notified the delivering carrier that he is not the beneficial owner of the property and has given in writing to such delivering carrier the name and address of such beneficial owner, such party shall not be liable for any additional charges which may be found to be due after delivery of the property; but if the party to whom delivery is made has given to the carrier erroneous information as to the beneficial owner, such party shall nevertheless be liable for such additional charges. If the shipper or consignor has given to the delivering carrier erroneous information as to who the beneficial owner is, such shipper or consignor shall himself be liable for such transportation charges, notwithstanding the foregoing provisions of this paragraph and irrespective of any provision to the contrary in the bill of lading or in the contract of transportation under which the shipment was made. The term "delivering carrier" means the last carrier making ultimate delivery.

Nothing herein shall limit the right of the carrier to require at time of shipment the prepayment or guarantee of the charges. If upon inspection it is ascertained that the articles shipped are not those described in this bill of lading, the freight charges must be paid upon the articles actually shipped.

Where delivery is made by a common carrier by water the foregoing provisions of this section shall apply, except as may be inconsistent with Part III of the Interstate Commerce Act.

Sec. 8. If this bill of lading is issued on the order of the shipper, or his agent, in exchange or in substitution for another bill of lading, the shipper's signature to the prior bill of lading as to the statement of value or otherwise, or election of common law or bill of lading liability, in or in connection with such prior bill of lading, shall be considered a part of this bill of lading as fully as if the same were written or made in or in connection with this bill of lading.

Sec. 9. (*a*) If all or any part of said property is carried by water over any part of said route, and loss, damage or injury to said property occurs while the same is in the custody of a carrier by water the liability of such carrier shall be determined by the bill of lading of the carrier by water (this bill of lading being such bill of lading if the property is transported by such water carrier thereunder) and by and under the laws and regulations applicable to transportation by water. Such water carriage shall be performed subject to all the terms and provisions of and all the exemptions from liability contained in the Act of the Congress of the United States, approved on February 13, 1893, and entitled "An act relating to the navigation of vessels, etc.," and of other statutes of the United States according carriers by water the protection of limited liability as well as the following stipulations of this section; and to the conditions contained in this bill of lading not inconsistent with this section, when this bill of lading becomes the bill of lading of the carrier by water.

(*b*) No such carrier by water shall be liable for any loss or damage resulting from any fire happening to or on board the vessel, or from explosion, bursting of boilers or breakage of shafts, unless caused by the design or neglect of such carrier.

(*c*) If the owners shall have exercised due diligence in making the vessel in all respects seaworthy and properly manned, equipped, and supplied, no such carrier shall be liable for any loss or damage resulting from the perils of the lakes, seas, or other waters, or from latent defects in hull, machinery, or appurtenances whether existing prior to, at the time of, or after sailing, or from collision, stranding, or other accidents of navigation, or from prolongation of the voyage. And, when for any reason it is necessary, any vessel carrying any or all of the property herein described shall be at liberty to call at any port or ports, in or out of the customary route, to tow and be towed, to transfer, trans-ship, or lighter cargo or any part thereof, to discharge goods at any time, to assist vessels in distress, to deviate for the purpose of saving life or property, and for docking and repairs. Except in case of negligence the carrier shall not be responsible for any loss or damage to property if it be necessary or is usual to carry the same upon deck.

(*d*) General average shall be payable according to the York-Antwerp Rules of 1924, Sections I to 15, inclusive, and Sections 17 to 22, inclusive, and as to matters not covered thereby according to the laws and usages of the Port of New York. If the owners shall have exercised due diligence to make the vessel in all respects seaworthy and properly manned, equipped and supplied, it is hereby agreed that in case of danger, damage or disaster resulting from faults or errors in navigation, or in the management of the vessel, or from any latent or other defects in the vessel, her machinery or appurtenances, or from unseaworthiness, whether existing at the time of shipment or at the beginning of the voyage (provided the latent or other defects or the unseaworthiness was not discoverable by the exercise of due diligence), the shippers, consignees and/or owners of the cargo shall nevertheless pay salvage and any special charges incurred in respect of the cargo, and shall contribute with the shipowner in general average to the payment of any sacrifices, losses or expenses of a general average nature that may be made or incurred for the common benefit or to relieve the adventure from any common peril.

(*e*) If the property is being carried under a tariff which provides that any carrier or carriers party thereto shall be liable for loss from perils of the sea, then as to such carrier or carriers the provisions of this section shall be modified in accordance with the tariff provisions, which shall be regarded as incorporated into the conditions of this bill of lading.

(*f*) The term "water carriage" in this section shall not be construed as including lighterage in or across rivers, harbors, or lakes, when performed by or on behalf of rail carriers.

Sec. 10. Any alteration, addition, or erasure in this bill of lading which shall be made without the special notation hereon of the agent of the carrier issuing this bill of lading, shall be without effect, and this bill of lading shall be enforceable according to its original tenor.

CAPCO KIN 0000391

90M Sets - 4

Form 3570

(For use in connection with Uniform Domestic Straight Bill of Lading, adopted by Carriers in Official, Southern, Western and Illinois Classification Territories, March 15, 1922, as amended August 1, 1930, and June 15, 1941.)

3rd SHEET

L&N **THIS MEMORANDUM** is an acknowledgment that a Bill of Lading has been issued and is not the Original Bill of Lading, nor a copy or duplicate, covering the property named herein, and is intended solely for filing or record.

Shipper's No.

Agent's No.

RECEIVED, subject to the classifications and tariffs in efftct on the date of the receipt by the carrier of the property described in the Original Bill of Lading.

at PIER: ~~XX~~ NORTH A A.S.D. MOBILE, ALA. 4/~~X~~5 19 67

from NORTH AMERICAN ASBESTOS PRODUCTS CO., CHICAGO, ILL.

the property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below, which said company (the word company being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its own road or its own water line, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the conditions not prohibited by law, whether printed or written, herein contained, including the conditions on back hereof, which are hereby agreed to by the shipper and accepted for himself and his assigns.

Consigned to CEMENT ASBESTOS PRODUCTS CO. (Mail or street address of consignee—For purposes of notification only.) (ORDER NO. RM-37)

Destination RAGLAND, State of ALA. County of

Route L&N - BHAM - SAL

Delivering Carrier Car Initial SEE Car No. BELOW

No. Packages	DESCRIPTION OF ARTICLES, SPECIAL MARKS, AND EXCEPTIONS	*WEIGHT (Subject to Correction)	CLASS OR RATE	CHECK COLUMN
2,100	BAGS CRUDE ASBESTOS	~~212000~~ 215600		
	EX: MUSI LLOYD, B/L 3, DURBAN			
	PIER: NO A, A.S.D., MOBILE, ALA.			
	MKD: S PRODUCT OF SOUTH AFRICA			
577	BAGS LOADED IN L&N 4719 G 105400 T ~~XXX~~ 47200 NET 58200			
	SEALS / 144762-63			
573	BAGS LOADED IN GN 27555 G 112300 T 52800 NET 59500			
	SEALS / 144760-61			
554	BAGS LOADED IN SOU 22970 G 107200 T 50100 NET 57100			
	SEALS / 144758-59			
396	BAGS LOADED IN C&EI 64083 TRLR CAR G 87800 T 47000 NET 40800			
	SEALS / 144769-70			

Subject to Section 7 of conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:

The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

(Signature of Consignor.)

If charges are to be prepaid, write or stamp here, "To be Prepaid."

COLLECT

Received $ to apply in prepayment of the charges on the property described hereon.

Agent or Cashier.

Per

(The signature here acknowledges only the amount prepaid.)

Charges Advanced:

TERMINAL RAILWAY, ALA.
STATE DOCKS, MOBILE, ALA.
Pure (Actual)
Tare (Marked)
Net
AUTHORITY of S.W. and I.R.

*If the shipment moves between two ports by a carrier by water, the law requires that the bill of lading shall state whether it is "carrier's or shipper's" weight.

NOTE—Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.

The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding per

N.D. CUNNINGHAM AND CO., INC. Shipper. L E BROWN Agent

Per Per HWE

Permanent postoffice address of Shipper

RECEIVED APR 5 1967 L&N R.R. CO. MOBILE, ALA.

CAPCO KIN 0000392

CONTRACT TERMS AND CONDITIONS

Sec. 1. (a) The carrier or party in possession of any of the property herein described shall be liable as at common law for any loss thereof or damage thereto, except as hereinafter provided.

(b) No carrier or party in possession of all or any of the property herein described shall be liable for any loss thereof or damage thereto or delay caused by the act of God, the public enemy, the authority of law, or the act or default of the shipper or owner, or for natural shrinkage. The carrier's liability shall be that of warehouseman, only, for loss, damage, or delay caused by fire occurring after the expiration of the free time allowed by tariffs lawfully on file (such free time to be computed as therein provided) after notice of the arrival of the property at destination or at the port of export (if intended for export) has been duly sent or given, and after placement of the property for delivery at destination, or tender of delivery of the property to the party entitled to receive it, has been made. Except in case of negligence of the carrier or party in possession (and the burden to prove freedom from such negligence shall be on the carrier or party in possession), the carrier or party in possession shall not be liable for loss, damage, or delay occurring while the property is stopped and held in transit upon the request of the shipper, owner, or party entitled to make such request, or resulting from a defect or vice in the property, or for country damage to cotton, or from riots or strikes.

(c) In case of quarantine the property may be discharged at risk and expense of owners into quarantine depot or elsewhere, as required by quarantine regulations or authorities, or for the carrier's dispatch at nearest available point in carrier's judgment, and in any such case carrier's responsibility shall cease when property is so discharged, or property may be returned by carrier at owner's expense to shipping point, earning freight both ways. Quarantine expenses of whatever nature or kind upon or in respect to property shall be borne by the owners of the property or be a lien thereon. The carrier shall not be liable for loss or damage occasioned by fumigation or disinfection or other acts required or done by quarantine regulations or authorities even though the same may have been done by carrier's officers, agents, or employees, nor for detention, loss, or damage of any kind occasioned by quarantine or the enforcement thereof. No carrier shall be liable, except in case of negligence, for any mistake or inaccuracy in any information furnished by the carrier, its agents, or officers, as to quarantine laws or regulations. The shipper shall hold the carriers harmless from any expense they may incur, or damages they may be required to pay, by reason of the introduction of the property covered by this contract into any place against the quarantine laws or regulations in effect at such place.

Sec. 2. (a) No carrier is bound to transport said property by any particular train or vessel, or in time for any particular market or otherwise than with reasonable dispatch. Every carrier shall have the right in case of physical necessity to forward said property by any carrier or route between the point of shipment and the point of destination. In all cases not prohibited by law, where a lower value than actual value has been represented in writing by the shipper or has been agreed upon in writing as the released value of the property as determined by the classification or tariffs upon which the rate is based, such lower value plus freight charges if paid shall be the maximum amount to be recovered, whether or not such loss or damage occurs from negligence.

(b) As a condition precedent to recovery, claims must be filed in writing with the receiving or delivering carrier, or carrier issuing this bill of lading, or carrier on whose line the loss, damage, injury or delay occurred, within nine months after delivery of the property (or, in case of export traffic, within nine months after delivery at port of export) or, in case of failure to make delivery, then within nine months after a reasonable time for delivery has elapsed; and suits shall be instituted against any carrier only within two years and one day from the day when notice in writing is given by the carrier to the claimant that the carrier has disallowed the claim or any part or parts thereof specified in the notice. Where claims are not filed or suits are not instituted thereon in accordance with the foregoing provisions, no carrier hereunder shall be liable, and such claims will not be paid.

(c) Any carrier or party liable on account of loss of or damage to any of said property shall have the full benefit of any insurance that may have been effected upon or on account of said property, so far as this shall not avoid the policies or contracts of insurance: *Provided*, That the carrier reimburse the claimant for the premium paid thereon.

Sec. 3. Except where such service is required as the result of carrier's negligence, all property shall be subject to necessary cooperage and baling at owner's cost. Each carrier over whose route cotton or cotton linters is to be transported hereunder shall have the privilege, at its own cost and risk, of compressing the same for greater convenience in handling or forwarding, and shall not be held responsible for deviation or unavoidable delays in procuring such compression. Grain in bulk consigned to a point where there is a railroad, public or licensed elevator, may (unless otherwise expressly noted herein, and then if it is not promptly unloaded) be there delivered and placed with other grain of the same kind and grade without respect to ownership (and prompt notice thereof shall be given to the consignor), and if so delivered shall be subject to a lien for elevator charges in addition to all other charges hereunder.

Sec. 4. (a) Property not removed by the party entitled to receive it within the free time allowed by tariffs, lawfully on file (such free time to be computed as therein provided), after notice of the arrival of the property at destination or at the port of export (if intended for export) has been duly sent or given, and after placement of the property for delivery at destination has been made, may be kept in vessel, car, depot, warehouse or place of delivery of the carrier, subject to the tariff charge for storage and to carrier's responsibility as warehouseman, only, or at the option of the carrier, may be removed to and stored in a public or licensed warehouse at the place of delivery or other available place, at the cost of the owner, and there held without liability on the part of the carrier, and subject to a lien for all freight and other lawful charges, including a reasonable charge for storage.

(b) Where non-perishable property which has been transported to destination hereunder is refused by consignee or the party entitled to receive it, or said consignee or party entitled to receive it fails to receive it within 15 days after notice of arrival shall have been duly sent or given, the carrier may sell the same at public auction to the highest bidder, at such place as may be designated by the carrier: *Provided*, That the carrier shall have first mailed, sent, or given to the consignor notice that the property has been refused or remains unclaimed, as the case may be, and that it will be subject to sale under the terms of the bill of lading if disposition be not arranged for, and shall have published notice containing a description of the property, the name of the party to whom consigned, or, if shipped order notify, the name of the party to be notified, and the time and place of sale, once a week for two successive weeks, in a newspaper of general circulation at the place of sale or nearest place where such newspaper is published: *Provided*, That 30 days shall have elapsed before publication of notice of sale after said notice that the property was refused or remains unclaimed was mailed, sent, or given.

(c) Where perishable property which has been transported hereunder to destination is refused by consignee or party entitled to receive it, or said consignee or party entitled to receive it shall fail to receive it promptly, the carrier may, in its discretion, to prevent deterioration or further deterioration, sell the same to the best advantage at private or public sale: *Provided*, That if time serves for notification to the consignor or owner of the refusal of the property or the failure to receive it and request for disposition of the property, such notification shall be given, in such manner as the exercise of due diligence requires, before the property is sold.

(d) Where the procedure provided for in the two paragraphs last preceding is not possible, it is agreed that nothing contained in said paragraphs shall be construed to abridge the right of the carrier at its option to sell the property under such circumstances and in such manner as may be authorized by law.

(e) The proceeds of any sale made under this section shall be applied by the carrier to the payment of freight, demurrage, storage, and any other lawful charges and the expense of notice, advertisement, sale, and other necessary expense, and of caring for and maintaining the property, if proper care of the same requires special expense, and should there be a balance it shall be paid to the owner of the property sold hereunder.

(f) Property destined to or taken from a station, wharf, or landing at which there is no regularly appointed freight agent shall be entirely at risk of owner after unloaded from cars or vessels or until loaded into cars or vessels, and, except in case of carrier's negligence, when received from or delivered to such stations, wharves, or landings shall be at owner's risk until the cars are attached to and after they are detached from locomotive or train or until loaded into and after unloaded from vessels.

Sec. 5. No carrier hereunder will carry or be liable in any way for any documents, specie, or for any articles of extraordinary value not specifically rated in the published classifications or tariffs unless a special agreement to do so and a stipulated value of the articles are indorsed hereon.

Sec. 6. Every party, whether principal or agent, shipping explosives or dangerous goods, without previous full written disclosure to the carrier of their nature, shall be liable for and indemnify the carrier against all loss or damage caused by such goods, and such goods may be warehoused at owner's risk and expense or destroyed without compensation.

Sec. 7. The owner or consignee shall pay the freight and average, if any, and all other lawful charges accruing on said property; but, except in those instances where it may lawfully be authorized to do so, no carrier by railroad shall deliver or relinquish possession at destination of the property covered by this bill of lading until all tariff rates and charges thereon have been paid. The consignor shall be liable for the freight and all other lawful charges, except that if the consignor stipulates, by signature, in the space provided for that purpose on the face of this bill of lading that the carrier shall not make delivery without requiring payment of such charges and the carrier, contrary to such stipulation, shall make delivery without requiring such payment, the consignor (except as hereinafter provided) shall not be liable for such charges. *Provided, That*, where the carrier has been instructed by the shipper or consignor to deliver said property to a consignee other than the shipper or consignor, such consignee shall not be legally liable for transportation charges in respect of the transportation of said property (beyond those billed against him at the time of delivery for which he is otherwise liable) which may be found to be due after the property has been delivered to him, if the consignee (a) is an agent only and has no beneficial title in said property, and (b) prior to delivery of said property has notified the delivering carrier in writing of the fact of such agency and absence of beneficial title, and, in the case of a shipment reconsigned or diverted to a point other than that specified in the original bill of lading, has also notified the delivering carrier in writing of the name and address of the beneficial owner of said property; and, in such cases the shipper or consignor, or, in the case of a shipment so reconsigned or diverted, the beneficial owner, shall be liable for such additional charges. If the consignee has given to the carrier erroneous information as to who the beneficial owner is, such consignee shall himself be liable for such additional charges. On shipments reconsigned or diverted by an agent who has furnished the carrier in the reconsignment or diversion order with a notice of agency and the proper name and address of the beneficial owner, and where such shipments are refused or abandoned at ultimate destination, the said beneficial owner shall be liable for all legally applicable charges in connection therewith. If the reconsignor or diverter has given to the carrier erroneous information as to who the beneficial owner is, such reconsignor or diverter shall himself be liable for all such charges.

If a shipper or consignor of a shipment of property (other than a prepaid shipment) is also the consignee named in the bill of lading and, prior to the time of delivery, notifies, in writing, a delivering carrier by railroad (a) to deliver such property at destination to another party, (b) that such party is the beneficial owner of such property, and (c) that delivery is to be made to such party only upon payment of all transportation charges in respect of the transportation of such property, and delivery is made by the carrier to such party without such payment, such shipper or consignor shall not be liable (as shipper, consignor, consignee, or otherwise) for such transportation charges but the party to whom delivery is so made shall in any event be liable for transportation charges billed against the property at the time of such delivery, and also for any additional charges which may be found to be due after delivery of the property, except that if such party prior to such delivery has notified in writing the delivering carrier that he is not the beneficial owner of the property, and has given in writing to such delivering carrier the name and address of such beneficial owner, such party shall not be liable for any additional charges which may be found to be due after delivery of the property; but if the party to whom delivery is made has given to the carrier erroneous information as to the beneficial owner, such party shall nevertheless be liable for such additional charges. If the shipper or consignor has given to the delivering carrier erroneous information as to who the beneficial owner is, such shipper or consignor shall himself be liable for such transportation charges, notwithstanding the foregoing provisions of this paragraph and irrespective of any provisions to the contrary in the bill of lading or in the contract of transportation under which the shipment was made. The term "delivering carrier" means the line-haul carrier making ultimate delivery.

Nothing herein shall limit the right of the carrier to require at time of shipment the prepayment or guarantee of the charges. If upon inspection it is ascertained that the articles shipped are not those described in this bill of lading, the freight charges must be paid upon the articles actually shipped.

Where delivery is made by a common carrier by water the foregoing provisions of this section shall apply, except as may be inconsistent with Part III of the Interstate Commerce Act.

Sec. 8. If this bill of lading is issued on the order of the shipper, or his agent, in exchange or in substitution for another bill of lading, the shipper's signature to the prior bill of lading as to the statement of value or otherwise, or election of common law or bill of lading liability, in or in connection with such prior bill of lading, shall be considered a part of this bill of lading as fully as if the same were written or made in or in connection with this bill of lading.

Sec. 9. (a) If all or any part of said property is carried by water over any part of said route, and loss, damage or injury to said property occurs while the same is in the custody of a carrier by water the liability of such carrier shall be determined by the bill of lading of the carrier by water (this bill of lading being such bill of lading if the property is transported by such water carrier alone) and by and under the rules and regulations applicable to transportation by water. Such water carriage shall be performed subject to all the terms and provisions of, and all the exemptions from liability contained in the Act of the Congress of the United States, approved on February 13, 1893, and entitled "An act relating to the navigation of vessels, etc.," and of other statutes of the United States according carriers by water the protection of limited liability, as well as the following subdivisions of this section; and to the conditions contained in this bill of lading not inconsistent with this section, when this bill of lading becomes the bill of lading of the carrier by water.

(b) No such carrier by water shall be liable for any loss or damage resulting from any fire happening to or on board the vessel, or from explosion, bursting of boilers or breakage of shafts, unless caused by the design or neglect of such carrier.

(c) If the owner shall have exercised due diligence in making the vessel in all respects seaworthy and properly manned, equipped, and supplied, no such carrier shall be liable for any loss or damage resulting from the perils of the lakes, seas, or other waters, or from latent defects in hull, machinery, or appurtenances whether existing prior to, at the time of, or after sailing, or from collision, stranding, or other accidents of navigation, or from prolongation of the voyage. And, when for any reason it is necessary, any vessel carrying any or all of the property herein described shall be at liberty to call at any port or ports, in or out of the customary route, to tow and be towed, to transfer, trans-ship, or lighter, to load and discharge goods at any time, to assist vessels in distress, to deviate for the purpose of saving life or property, and for docking and repairs. Except in case of negligence such carrier shall not be responsible for any loss or damage to property if it be necessary or is usual to carry the same upon deck.

(d) General Average shall be payable according to the York-Antwerp Rules of 1924, Sections 1 to 15, inclusive, and Sections 17 to 22, inclusive, and as to matters not covered thereby according to the laws and usages of the Port of New York. If the owners shall have exercised due diligence to make the vessel in all respects seaworthy and properly manned, equipped and supplied, it is hereby agreed that in case of danger, damage or disaster resulting from faults or errors in navigation, or in the management of the vessel, or from any latent or other defects in the vessel, her machinery or appurtenances, or from unseaworthiness, whether existing at the time of shipment or at the beginning of the voyage (provided the latent or other defects or the unseaworthiness was not discoverable by the exercise of due diligence), the shippers, consignees and owners of the cargo shall nevertheless pay salvage and any special charges incurred in respect of the cargo, and shall contribute with the shipowner in general average to the payment of any sacrifices, losses or expenses of a general average nature that may be made or incurred for the common benefit or to relieve the adventure from any common peril.

(e) If the property is being carried under a tariff which provides that any carrier or carriers party thereto shall be liable for loss from perils of the sea, then as to such carrier or carriers the provisions of this section shall be modified in accordance with the tariff provisions, which shall be regarded as incorporated into the conditions of this bill of lading.

(f) The term "water carriage" in this section shall not be construed as including lighterage in or across rivers, harbors, or lakes, when performed by or on behalf of rail carriers.

Sec. 10. Any alteration, addition, or erasure in this bill of lading which shall be made without the special notation hereon of the agent of the carrier issuing this bill of lading, shall be without effect, and this bill of lading shall be enforceable according to its original tenor.

CAPCO KIN 000039

ARRIVAL NOTICE AND COPY OF BILL FOR PAYMENT OF FREIGHT CHARGES

FORM 7-A

TO SEABOARD AIR LINE RAILROAD COMPANY, HAS RECEIVED THE FOLLOWING ARTICLES CONSIGNED TO YOU

Ragland, Ala. STATION April 13, 1967 19

CONSIGNEE Cement Asbestos Products Co. FREIGHT BILL NO. 340

ROUTE (POINT OF ORIGIN TO DESTINATION) L&N-Bham-SAL.

WAYBILLED FROM	WAYBILL DATE AND NUMBER	FULL NAME OF SHIPPER	CAR INITIAL AND NUMBER
Mobile, Ala.	4-5-67 124947	North American Asbestos Prods Co. (See below)	
POINT AND DATE OF SHIPMENT	CONNECTING LINE REFERENCE	PREVIOUS WAYBILL REFERENCE	ORIGINAL CAR INITIAL AND NUMBER

WEIGHED AT Mobile State Docks, Ala. GROSS TARE NET

NUMBER OF PACKAGES, ARTICLES AND MARKS	WEIGHT	RATE	FREIGHT	ADVANCES	TOTAL
2100 Bags crude Asbestos	216600	.88	1897.28		
577 bags in L&N 4719, weight:	WFG.	.28T		30.18	
G-105400, T-47200, N-58200.	Hdlg.	1.61T		173.56	
573 bags in GN 27555, weight:				203.74	$2101.02
G-112300, T-52800, N-59500.					
554 bags in SOU 22970, weight:					
G-107200, T-50100, N-57100.					
396 bags in CSXI 64083, weight:					
G-77900, T-47000, N-40800.					

DATE MATERIAL RECEIVED 4-13-67

CHARGE 53-2 (9-5)

APPROVED—STOREKEEPER [illegible]

The above shipment to your consignment has arrived at this station, and is ready for delivery. Unless unloaded or removed within free period allowed by published rules, same will be subject to demurrage or storage charges, as provided for in said rules. Unless this shipment is removed promptly it will be subject to sale as provided in the terms of the bill of lading.

Please deliver this consignment to bearer.

Consignee

Thank You-Your Business is Appreciated

MAKE CHECK PAYABLE TO SEABOARD AIR LINE RAILROAD COMPANY

APR 27 1967

NORTH AMERICAN ASBESTOS CORPORATION

200 SOUTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60604

TELEPHONE (312) 922-7435

INVOICE No. 5444

DATE April 26, 1967

CUSTOMER ORDER NO. RM-41

OUR ORDER NO. 1987-1

SOLD TO

Cement Asbestos Products Company

Woodward, Alabama 35189

SHIPPED TO

Cement Asbestos Products Co.
Ragland, Alabama
Attn: W. H. Beasley

SHIPPED VIA ss "Jesse Lykes" to Port of Mobile

SHIPPING DATE April 24, 1967

QUANTITY	DESCRIPTION	PRICE	TOTAL
100 tons (2,000 bags)	Grade OWS Blue Fiber	@ $223.00 per ton f. o. b. vessel pt. of Mobile	$22,300.00
	First Partial Shipment	1,973.32	
	Terms: Net Ten Days		

REGISTER 2315
INVOICE DATE 04 26
DATE TO BE PAID 05 02
INVOICE NO. 10502
GL ACCT. 06
INVOICE AMT 22,300.00
DISCOUNT
TYPE DISC.

CAPCO KIN 0000395

FORM 7-A

ARRIVAL NOTICE AND COPY OF BILL FOR PAYMENT OF FREIGHT CHARGES

TO SEABOARD AIR LINE RAILROAD COMPANY, HAS RECEIVED THE FOLLOWING ARTICLES CONSIGNED TO YOU

a land, Fla. STATION May 16, 1967 19

CONSIGNEE Cement Asbestos Products Co. FREIGHT BILL NO. 505

ROUTE (POINT OF ORIGIN TO DESTINATION) [illegible]

WAYBILLED FROM	WAYBILL DATE AND NUMBER	FULL NAME OF SHIPPER	CAR INITIAL AND NUMBER
[illegible], Ala.	[illegible]-3-67 120628	[illegible]	([illegible] below)
POINT AND DATE OF SHIPMENT	CONNECTING LINE REFERENCE	PREVIOUS WAYBILL REFERENCE	ORIGINAL CAR INITIAL AND NUMBER

WEIGHED AT [illegible], Ala. GROSS (see below) TARE NET

NUMBER OF PACKAGES, ARTICLES AND MARKS	WEIGHT	RATE	FREIGHT	ADVANCES	TOTAL
[illegible] asbestos	[illegible]	[illegible]	[illegible].12		
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Pre [illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
				370.02	[illegible]

DATE MATERIAL RECEIVED 5-15-67 [illegible]

CHARGE 53.2 (9.5)

APPROVED—STOREKEEPER [illegible]

The above shipment to your consignment has arrived at this station, and is ready for delivery. Unless unloaded or removed within free period allowed by published rules, same will be subject to demurrage or storage charges, as provided for in said rules. Unless this shipment is removed promptly it will be subject to sale as provided in the terms of the bill of lading.

Please deliver this consignment to bearer.

_____ Consignee

Thank You-Your Business is Appreciated

MAKE CHECK PAYABLE TO SEABOARD AIR LINE RAILROAD COMPANY

CAPCO KIN 0000396

20M Sets - 4-65 Form 3570

(Uniform Domestic Straight Bill of Lading, adopted by Carriers in Official, Southern, Western and Illinois Classification Territories, March 15, 1922, as amended August 1, 1930 and June 15, 1941.) 1st SHEET

L&N

UNIFORM STRAIGHT BILL OF LADING

ORIGINAL—NOT NEGOTIABLE

Shipper's No.

Agent's No.

Louisville & Nashville Railroad Company

RECEIVED, subject to the classifications and tariffs in effect on the date of the issue of this Bill of Lading,

at MOBILE, ALA. - PIER SOUTH C, A.S.D. MAY 3RD, 1967, 19

from NORTH AMERICAN ASBESTOS CORPN. 200 SOUTH MICHIGAN AVE., CHICAGO, ILL.

the property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below, which said company (the word company being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its own road or its own water line, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the conditions not prohibited by law, whether printed or written, herein contained, including the conditions on back hereof, which are hereby agreed to by the shipper and accepted for himself and his assigns.

Consigned to CEMENT ASBESTOS PRODUCTS CO. (Mail or street address of consignee—For purposes of notification only.)

Destination RAGLAND State of ALA. County of

Route L&N BHAM SAL

Delivering Carrier Car Initial Car No. SEVEN CARS - SEE BELOW

No. Packages	DESCRIPTION OF ARTICLES, SPECIAL MARKS, AND EXCEPTIONS	*WEIGHT (Subject to Correction)	CLASS OR RATE	CHECK COLUMN
3880	BAGS CRUDE ASBESTOS	392400		
	EX "JESSE LYKES" B/L 3 & 4 DURBAN			
	PIER SOUTH C			
	MKD: S MOBILE			

TERMINAL RAILWAY
STATE DOCKS
Gross
Tare
Tare (Tacks)
Net
Capacity
AUTHORITY of S. W. and I. B.

IC 29030 CONTAINS 579 BAGS G 105100 T [illegible] NET 59500
SEALS: 151[illegible] - 151786
RI [illegible] CONTAINS 580 BAGS G 105300 T 47600 NET 57700
SEALS: 151730 & 151796
RI 27102 CONTAINS 580 BAGS G 106300 T 47500 NET 58800
SEALS: 151783-84
N&W 219463 CONTAINS 582 BAGS G 103800 T 45000 NET 58800
SEALS: 151608 & 151610
SP 117731 CONTAINS 580 BAGS G 104800 T 45000 NET 59800
SEALS: 151622 & 151629
NYC 163015 CONTAINS 579 BAGS G 106000 T 47700 NET 58300
SEALS: 151614 & 151719
SP 124358 CONTAINS 400 BAGS G 83200 T 42700 NET 40500 (TRLR CAR)
SEALS: 144711-12
EXCEPTIONS: NYC 163015 - 19 BAGS TORN CONTENTS SPILLING
N&W 219463 - 17 BAGS TORN CONTENTS SPILLING
SP 117731 - 18 BAGS TORN CONTENTS SPILLING

Subject to Section 7 of conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:

The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

(Signature of Consignor.)

If charges are to be prepaid, write or stamp here, "To be Prepaid."

COLLECT

Received $ to apply in prepayment of the charges on the property described hereon.

Agent or Cashier.

Per

(The signature here acknowledges only the amount prepaid.)

Charges Advanced

$

*If the shipment moves between two ports by a carrier by water, the law requires that the bill of lading shall state whether it is "carrier's or shipper's weight."

NOTE—Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.

The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

per

N. D. CUNNINGHAM & CO., INC. Shipper HUGH JUSTICE, MCS Agent

Per MABEL GREER Per HWE

Permanent postoffice address of Shipper P. O. BOX 15, MOBILE, ALA.

RECEIVED MAY 3 1967 L&N FREIGHT OFFICE MOBILE, ALA.

CAPCO KIN 0000397

NORTH AMERICAN ASBESTOS CORPORATION

200 SOUTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60604

TELEPHONE (312) 922-7435

APR 1 1967

INVOICE No. 5445

DATE April 26, 1967

CUSTOMER ORDER NO. RM-37

OUR ORDER NO. 1973-2F

SOLD TO

Cement Asbestos Products Company

Woodward, Alabama

SHIPPED TO

Cement Asbestos Products Co.
Ragland, Alabama
Attn: W. H. Beasley

SHIPPED VIA ss "Jesse Lykes" to Port of Mobile
Rail freight to your plant

SHIPPING DATE April 24, 1967

QUANTITY	DESCRIPTION	PRICE	TOTAL
93.75 tons (1,879 bags)	Grade OWS Blue Fiber	@ $223.00 per ton f. o. b. vessel Pt. of Mobile	$20,906.25
	Second & Final Shipment		
	Terms: Net Ten Days		

REGISTER 2316
INVOICE DATE 0426
DATE TO BE PAID 0522
LIST NO. 10502
C.O. ACCT ab
INVOICE AMT. 20,906.25
DISCOUNT
TAKE DIS

CAPCO KIN 0000398

2M Sets - 4-65 Form 3570

(Uniform Domestic Straight Bill of Lading, adopted by Carriers in Official, Southern, Western and Illinois Classification Territories, March 15, 1922, as amended August 1, 1930 and June 15, 1941.) 1st SHEET

UNIFORM STRAIGHT BILL OF LADING

Shipper's No.

ORIGINAL—NOT NEGOTIABLE

Agent's No.

Louisville & Nashville Railroad Company

RECEIVED, subject to the classifications and tariffs in effect on the date of the issue of this Bill of Lading,

at MOBILE, ALA. - PIER SOUTH C, A.S.D. MAY 3RD, 1967 19

from NORTH AMERICAN ASBESTOS CORPN. 200 SOUTH MICHIGAN AVE., CHICAGO, ILL.

the property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below, which said company (the word company being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its own road or its own water line, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the conditions not prohibited by law, whether printed or written, herein contained, including the conditions on back hereof, which are hereby agreed to by the shipper and accepted for himself and his assigns.

(Mail or street address of consignee—For purposes of notification only.)

Consigned to CEMENT ASBESTOS PRODUCTS CO.

Destination RAGLAND State of ALA. County of

Route L&N BHAM SAL BELOW

SEVEN CARS - SEE ~~ATTACHED~~

Delivering Carrier Car Initial Car No.

No. Packages	DESCRIPTION OF ARTICLES, SPECIAL MARKS, AND EXCEPTIONS	*WEIGHT (Subject to Correction)	CLASS OR RATE	CHECK COLUMN
3880	BAGS CRUDE ASBESTOS	392400		
	EX "JESSE LYKES" B/L 3 & 4 DURBAN			
	PIER SOUTH C			
	MKD: S MOBILE			

TERMINAL RAILWAY STATE DOCKS
Gross
Tare
Tare (Marked)
Net
Capacity
AUTHORITY of S. W. and L. S.

IC 29030 CONTAINS 579 BAGS G 105100 T 46600 NET 58500
SEALS: 151758 & 151786
RI 26898 CONTAINS 580 BAGS G 105300 T 47600 NET 57700
SEALS: 151730 & 151796
RI 27102 CONTAINS 580 BAGS G 106300 T 47500 NET 58800
SEALS: 151783-84
N&W 219463 CONTAINS 582 BAGS G 103800 T 45000 NET 58800
SEALS: 151608 & 151610
SP 117731 CONTAINS 580 BAGS G 104800 T 45000 NET 59800
SEALS: 151622 & 151629
NYC 163015 CONTAINS 579 BAGS G 106000 T 47700 NET 58300
SEALS: 151614 & 151719
SP 124358 CONTAINS 400 BAGS G 83200 T 42700 NET 40500 (TRLR CAR)
SEALS: 144711-12
EXCEPTIONS: NYC 163015 - 19 BAGS TORN CONTENTS SPILLING
N&W 219463 - 17 BAGS TORN CONTENTS SPILLING
SP 117731 - 18 BAGS TORN CONTENTS SPILLING

Subject to Section 7 of conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:

The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

(Signature of Consignor.)

If charges are to be prepaid, write or stamp here, "To be Prepaid."

COLLECT

Received $ to apply in prepayment of the charges on the property described hereon.

Agent or Cashier.

Per

(The signature here acknowledges only the amount prepaid.)

Charges Advanced: $

*If the shipment moves between two or more carriers by water, the law requires that the bill of lading shall state whether it is carrier's or shipper's weight.

NOTE—Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.

The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding per

N. D. CUNNINGHAM & CO., INC. Shipper HUGH JUSTICE, MCS Agent

Per MABEL GREER Per HWE

Permanent postoffice address of Shipper P. O. BOX 15, MOBILE, ALA.

CAPCO KIN 000039

ARRIVAL NOTICE AND COPY OF BILL FOR PAYMENT OF FREIGHT CHARGES

FORM 7-A

TO SEABOARD AIR LINE RAILROAD COMPANY, HAS RECEIVED THE FOLLOWING ARTICLES CONSIGNED TO YOU

1474

[illegible]a land, Ala. STATION [illegible] 16, 1967 19

CONSIGNEE [illegible] FREIGHT BILL NO. 505

ROUTE (POINT OF ORIGIN TO DESTINATION) [illegible]

WAYBILLED FROM	WAYBILL DATE AND NUMBER	FULL NAME OF SHIPPER	CAR INITIAL AND NUMBER
[illegible]	[illegible]	[illegible]	(See Below)
POINT AND DATE OF SHIPMENT	CONNECTING LINE REFERENCE	PREVIOUS WAYBILL REFERENCE	ORIGINAL CAR INITIAL AND NUMBER

WEIGHED AT [illegible] GROSS (See below) TARE NET

NUMBER OF PACKAGES, ARTICLES AND MARKS	WEIGHT	RATE	FREIGHT	ADVANCES	TOTAL
[illegible]	392[illegible]	[illegible]58	[illegible]53.12		
[illegible]					
[illegible]				[illegible].94	Pro Rated
[illegible]				[illegible]	
[illegible]				[illegible]	
[illegible]					
[illegible]					
[illegible]					
[illegible]					

DATE MATERIAL RECEIVED 5-15-67

CHARGE 53-2 (4-5)

APPROVED—STOREKEEPER [illegible] 1850

The above shipment to your consignment has arrived at this station, and is ready for delivery. Unless unloaded or removed within free period allowed by published rules, same will be subject to demurrage or storage charges, as provided for in said rules. Unless this shipment is removed promptly it will be subject to sale as provided in the terms of the bill of lading.

Please deliver this consignment to bearer.

_____ Consignee

Thank You-Your Business is Appreciated

MAKE CHECK PAYABLE TO SEABOARD AIR LINE RAILROAD COMPANY

CAPCO KIN 0000400

DATE OF INVC.	DIV.	AMOUNT	DISCOUNT	NET
5/12	1	22,300.00		22,300.00

000460

STATEMENT OF REMITTANCE

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA

ACCEPTANCE OF THIS CHECK WILL BE CONSIDERED FULL PAYMENT OF ITEMS LISTED ON THIS VOUCHER.

APPROVED	MO.	DAY	YR.	TOTAL	VENDOR
	06	09	97	22,300.00	NORTH AMER ASBESTOS CORP

DETACH AND RETAIN FOR YOUR FILE

MAY 18 1967

NORTH AMERICAN ASBESTOS CORPORATION

200 SOUTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60604

TELEPHONE (312) 922-7435

INVOICE № 5466

DATE May 15, 1967

CUSTOMER ORDER NO. RM-41

OUR ORDER NO. 1987-2

SHIPPED TO

Cement Asbestos Products Co.
Ragland, Alabama

SOLD TO

Cement Asbestos Products Company

Woodward, Alabama

ss "James McKay" to Port of Mobile

SHIPPED VIA Rail freight to your plant

SHIPPING DATE May 12, 1967

QUANTITY	DESCRIPTION	PRICE	TOTAL
100 tons (2,000 bags)	Grade "Open S" Blue Fiber	@ $223.00 per ton f.o.b. vessel Pt. of Mobile	$22,300.00
	Second & Final Shipment		
	Terms: Net Ten Days		

5/18 SP

June

Sal

1,975.31

583

5-26-67 D. Cruch

CHARGE 9-5

LIST NO. 1

AB

APPROVAL W. W. Jamison

REGISTER

INVOICE DATE 0512

DATE TO BE PAID 0609

LIST NO. 10601

G-L ACCT. AB

INVOICE AMT. 22300.00

DISCOUNT

TYPE DISC.

CAPCO KIN 000040

20M 8c'a - 4-65 Form 3570

(Uniform Domestic Straight Bill of Lading, adopted by Carriers in Official, Southern, Western and Illinois Classification Territories, March 15, 1922, as amended August 1, 1930 and June 15, 1941.) 1st SHEET

UNIFORM STRAIGHT BILL OF LADING

ORIGINAL—NOT NEGOTIABLE

Shipper's No._____

Agent's No._____

Louisville & Nashville Railroad Company

RECEIVED, subject to the classifications and tariffs in effect on the date of the issue of this Bill of Lading.

at PIER SOUTH C, A.S.D. MOBILE, ALABAMA MAY 25, 19 67

from NORTH AMERICAN ASBESTOS PRODUCTS CO. 200 SOUTH MICHIGAN AVE, CHICAGO ILL

the property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below, which said company (the word company being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its own road or its own water line, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the conditions not prohibited by law, whether printed or written, herein contained, including the conditions on back hereof, which are hereby agreed to by the shipper and accepted for himself and his assigns.

Consigned to CEMENT ASBESTOS PRODUCTS CO. (Mail or street address of consignee—For purposes of notification only.)

Destination RAGLAND, ALA. State of_____ County of_____

Route L & N BHM SAL

Delivering Carrier SAL Car Initial SEE Car No. BELOW

No. Packages	DESCRIPTION OF ARTICLES, SPECIAL MARKS, AND EXCEPTIONS	*WEIGHT (Subject to Correction)	CLASS OR RATE	CHECK COLUMN
2000	BAGS BLUE ASBESTOS	202,000		
		202,700		
L&N	100655 CONTAINS 754 BAGS - G 139500 T 63200 NET 76300			
	SEALS: 150207-08			
L&N	100602 CONTAINS 753 BAGS - G 138900 T 63000 NET 75900			
	SEALS: 150205-06			
CB&Q	24459 CONTAINS 493 BAGS - G 105400 T 54900 NET 50500			
	EX: JAMES MCKAY B/L 1 DURBAN			
	PIER SOUTH C			
	MKD: S			

TERMINAL RAILWAY, ALA. STATE Ddocks, MOBILE, ALA. Gross_____ Tare (Truck)_____ Tare (Trailer)_____ Net_____ Capacity_____ Length_____ AUTHORITY of L. N. and I. C.

Subject to Section 7 of conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:

The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

(Signature of Consignor.)

If charges are to be prepaid, write or stamp here, "To be Prepaid."

COLLECT

Received $_____ to apply in prepayment of the charges on the property described hereon.

Agent or Cashier.

Per_____

(The signature here acknowledges only the amount prepaid.)

Charges Advanced: $_____

RECEIVED MAY 25 1967 L. & N. R. R. CO. MOBILE, ALA.

*If the shipment moves between two ports by a carrier by water, the law requires that the bill of lading shall state whether it is "carrier's or shipper's weight."

NOTE—Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.

The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding _____ per_____

N.D. CUNNINGHAM AND CO. Shipper. HUGH JUSTICE, MCS Agent

Per Mabel Grant Per HWE

Permanent postoffice address of Shipper P.O. BOX 15, MOBILE, ALABAMA

CAPCO KIN 0000403

DELIVERY RECEIPT

FORM 7-A

RECEIVED FROM SEABOARD AIR LINE RAILROAD COMPANY, IN GOOD CONDITION THE ARTICLES DESCRIBED BELOW:

STATION 3305 Ragland Ala. 6-5- 1967

CONSIGNEE Cement Asbestos Products Co.

ROUTE L&N Bgham SAL (POINT OF ORIGIN TO DESTINATION)

FREIGHT BILL NO. 583

WAYBILLED FROM	WAYBILL DATE AND NUMBER	FULL NAME OF SHIPPER	CAR INITIAL AND NUMBER
Mobile Alabama	5-25-67 127874	North American Asbestos Pro.Co.	SEE BELOW
POINT AND DATE OF SHIPMENT	CONNECTING LINE REFERENCE	PREVIOUS WAYBILL REFERENCE	ORIGINAL CAR INITIAL AND NUMBER

WEIGHED AT Mobile Alabama GROSS SEE BELOW TARE NET

NUMBER OF PACKAGES, ARTICLES AND MARKS	WEIGHT	RATE	FREIGHT	ADVANCES	TOTAL
Three (3) Cars Blue Asbestos Fibre					
L&N 100655-754 Bags GNT 139500 Tare 63200	76300				
L&N 100602-753 " " 138900 " 63000	75900				
CBQ 24459-493 " " 105400 " 54900	50500				
	202700	.88	1783.76		
		.28NT		28.38	1975.31
Wrarfage Handling		.161NT		163.17	COLLECT
				191.55	
					5-26-67

NOTICE MAILED _____ 19____ DATE OF DELIVERY _____ 19____

SIGNATURE

CHARGE 53-2 9-5

APPROVED—STORCKEEPER _____ CONSIGNEE

PER _____

Thank You-Your Business is Appreciated

001348

DATE OF INVOICE	DIV	AMOUNT	DISCOUNT	NET
11/30	1	22,300 00		22,300 00

STATEMENT OF REMITTANCE

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA

ACCEPTANCE OF THIS CHECK WILL BE CONSIDERED FULL PAYMENT OF ITEMS LISTED ON THIS VOUCHER.

APPROVED	MO	DAY	YR	TOTAL	VENDOR
	12	15	67	22,300 00	NORTH AMER ASBESTOS CORP

DETACH AND RETAIN FOR YOUR FILE

CAPCO KIN 0000405

DEC 6 1967 DEC 6 1967

NORTH AMERICAN ASBESTOS CORPORATION

200 SOUTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60604

TELEPHONE (312) 922-7435

INVOICE Nº 5659

DATE November 30, 1967

CUSTOMER ORDER NO. RM-44

OUR ORDER NO. 2023-1

SOLD TO

Cement Asbestos Products Company

Woodward, Alabama

4498

SHIPPED TO

Cement Asbestos Prod. Co.

Ragland, Alabama

SHIPPED VIA ss "Velma Lykes" to Port of Mobile SHIPPING DATE November 30, 1967

QUANTITY	DESCRIPTION	PRICE	TOTAL
100 tons (2,000 bags)	Grade S Blue Fiber	@ $223.00 per ton f.o.b. vessel Port of Mobile	$22,300.00
	Storage Charge for Your Account		
	First Partial Shipment		
	TERMS: Net Ten Days		

12/6 APPROV

Dec

8CL

1,864.84

1150

EXEMPT FROM ALL TAXES SALES ON USE TAX

12-8-67

D Cruel

9-5

2

APPRO

APPROVAL

CAPCO KIN 0000406

300M 12-62 AMS Form 3508

(Uniform Domestic Straight Bill of Lading, adopted by Carriers in Official, Southern, Western and Illinois Classification Territories, March 15, 1922, as amended August 1, 1930 and June 15, 1941.) 1st SHEET

UNIFORM STRAIGHT BILL OF LADING

Shipper's No. B-15264

ORIGINAL—NOT NEGOTIABLE

Agent's No.

L&N

Louisville & Nashville Railroad Company

RECEIVED, subject to the classifications and tariffs in effect on the date of the issue of this Bill of Lading,

at Mobile, Alabama (ASD) November ~~22~~ 30th, 19 67

from Cement Asbestos Product Corp.

the property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below, which said company (the word company being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its own road or its own water line, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the conditions not prohibited by law, whether printed or written, herein contained, including the conditions on back hereof, which are hereby agreed to by the shipper and accepted for himself and his assigns.

(Mail or street address of consignee—For purposes of notification only.)

Consigned to Cement Asbestos Products Corp.

Destination Ragland State of Alabama County of

Route L&N - Sal

Delivering Carrier Car Initial SEE Car No. BELOW

No. Packages	DESCRIPTION OF ARTICLES, SPECIAL MARKS, AND EXCEPTIONS	*WEIGHT (Subject to Correction)	CLASS OR RATE	CHECK COLUMN
1986	Bags Blue Asbestos	~~198,600 #~~ 202700		
	Ex S/S Reuben Tipton W/R # 75 Durban 3			
L&N	98726 CONTAINS 705 BAGS - G 127300 T 54900 NET 72400 SEALS: 155565-66			
~~NYC~~	~~71480 CONTAINS 705 BAGS - G 128100 T 56700 NET 71400 SEALS: 155567-68~~			
CG	2638 CONTAINS 576 BAGS - G 119800 T 60900 NET 58900 SEALS: 155571-72			

Subject to Section 7 of conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:

The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

(Signature of Consignor.)

If charges are to be prepaid, write or stamp here, "To be Prepaid."

COLLECT

Received $ to apply in prepayment of the charges on the property described hereon.

Agent or Cashier.

Per

(The signature here acknowledges only the amount prepaid.)

Charges Advanced: $

TERMINAL RAILWAY, ALA
STATE DOCKS, MOBILE, ALA.
Gross
Tare (Actual)
Tare (Marked)
Net

RECEIVED NOV 30 1967 L&N R.R. MOBILE, ALA.

*If the shipment moves between two ports by a carrier by water, the law requires that the bill of lading shall state whether it is "carrier's or shipper's weight."

NOTE—Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.

The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

Cement Asbestos Prod Corp. per

Ragland, Alabama Shipper. Hugh Justicek MCSA Agent

Per ASD (MW) Per

Permanent postoffice address of Shipper

Trans. 1

CAPCO KIN 0000407

CONTRACT TERMS AND CONDITIONS

Sec. 1. (a) The carrier or party in possession of any of the property herein described shall be liable as at common law for any loss thereof or damage thereto, except as hereinafter provided.

(b) No carrier or party in possession of all or any of the property herein described shall be liable for any loss thereof or damage thereto or delay caused by the act of God, the public enemy, the authority of law, or the act or default of the shipper or owner, or for natural shrinkage. The carrier's liability shall be that of warehouseman, only, for loss, damage, or delay caused by fire occurring after the expiration of the free time allowed by tariffs lawfully on file (such free time to be computed as therein provided) after notice of the arrival of the property at destination or at the port of export (if intended for export) has been duly sent or given, and after placement of the property for delivery at destination, or tender of delivery of the property to the party entitled to receive it, has been made. Except in case of negligence of the carrier or party in possession (and the burden to prove freedom from such negligence shall be on the carrier or party in possession), the carrier or party in possession shall not be liable for loss, damage, or delay occurring while the property is stopped and held in transit upon the request of the shipper, owner, or party entitled to make such request, or resulting from a defect or vice in the property, or for country damage to cotton, or from riots or strikes.

(c) In case of quarantine the property may be discharged at risk and expense of owners into quarantine depot or elsewhere, as required by quarantine regulations or authorities, or for the carrier's dispatch at nearest available point in carrier's judgment, and in any such case carrier's responsibility shall cease when property is so discharged, or property may be returned by carrier at owner's expense to shipping point, earning freight both ways. Quarantine expenses of whatever nature or kind upon or in respect to property shall be borne by the owners of the property or be a lien thereon. The carrier shall not be liable for loss or damage occasioned by fumigation or disinfection or other acts required or done by quarantine regulations or authorities even though the same may have been done by carrier's officers, agents, or employees, nor for detention, loss, or damage of any kind occasioned by quarantine or the enforcement thereof. No carrier shall be liable, except in case of negligence, for any mistake or inaccuracy in any information furnished by the carrier, its agents, or officers, as to quarantine laws or regulations. The shipper shall hold the carriers harmless from any expense they may incur, or damages they may be required to pay, by reason of the introduction of the property covered by this contract into any place against the quarantine laws or regulations in effect at such place.

Sec. 2. (a) No carrier is bound to transport said property by any particular train or vessel, or in time for any particular market or otherwise than with reasonable dispatch. Every carrier shall have the right in case of physical necessity to forward said property by any carrier or route between the point of shipment and the point of destination. In all cases not prohibited by law, where a lower value than actual value has been represented in writing by the shipper or has been agreed upon in writing as the released value of the property as determined by the classification or tariffs upon which the rate is based, such lower value plus freight charges if paid shall be the maximum amount to be recovered, whether or not such loss or damage occurs from negligence.

(b) As a condition precedent to recovery, claims must be filed in writing with the receiving or delivering carrier, or carrier issuing this bill of lading, or carrier on whose line the loss, damage, injury or delay occurred, within nine months after delivery of the property (or, in case of export traffic, within nine months after delivery at port of export) or, in case of failure to make delivery, then within nine months after a reasonable time for delivery has elapsed; and suits shall be instituted against any carrier only within two years and one day from the day when notice in writing is given by the carrier to the claimant that the carrier has disallowed the claim or any part or parts thereof specified in the notice. Where claims are not filed or suits are not instituted thereon in accordance with the foregoing provisions, no carrier hereunder shall be liable, and such claims will not be paid.

(c) Any carrier or party liable on account of loss of or damage to any of said property shall have the full benefit of any insurance that may have been effected upon or on account of said property, so far as this shall not avoid the policies or contracts of insurance: Provided, That the carrier reimburse the claimant for the premium paid thereon.

Sec. 3. Except where such service is required as the result of carrier's negligence, all property shall be subject to necessary cooperage and baling at owner's cost. Each carrier over whose route cotton or cotton linters is to be transported hereunder shall have the privilege, at its own cost and risk, of compressing the same for greater convenience in handling or forwarding, and shall not be held responsible for deviation or unavoidable delays in procuring such compression. Grain in bulk consigned to a point where there is a railroad, public or licensed elevator, may (unless otherwise expressly noted herein, and then if it is not promptly unloaded) be there delivered and placed with other grain of the same kind and grade without respect to ownership (and prompt notice thereof shall be given to the consignor), and if so delivered shall be subject to a lien for elevator charges in addition to all other charges hereunder.

Sec. 4. (a) Property not removed by the party entitled to receive it within the free time allowed by tariffs lawfully on file (such free time to be computed as therein provided), after notice of the arrival of the property at destination or at the port of export (if intended for export) has been duly sent or given, and after placement of the property for delivery at destination has been made, may be kept in vessel, car, depot, warehouse or place of delivery of the carrier, subject to the tariff charge for storage and to carrier's responsibility as warehouseman, only, or at the option of the carrier, may be removed to and stored in a public or licensed warehouse at the place of delivery or other available place, at the cost of the owner, and there held without liability on the part of the carrier, and subject to a lien for all freight and other lawful charges, including a reasonable charge for storage.

(b) Where nonperishable property which has been transported to destination hereunder is refused by consignee or the party entitled to receive it, or said consignee or party entitled to receive it fails to receive it within 15 days after notice of arrival shall have been duly sent or given, the carrier may sell the same at public auction to the highest bidder, at such place as may be designated by the carrier: Provided, That the carrier shall have first mailed, sent, or given to the consignor notice that the property has been refused or remains unclaimed, as the case may be, and that it will be subject to sale under the terms of the bill of lading if disposition be not arranged for, and shall have published notice containing a description of the property, the name of the party to whom consigned, or, if shipped order notify, the name of the party to be notified, and the time and place of sale, once a week for two successive weeks, in a newspaper of general circulation at the place of sale or nearest place where such newspaper is published: Provided, That 30 days shall have elapsed before publication of notice of sale after said notice that the property was refused or remains unclaimed was mailed, sent, or given.

(c) Where perishable property which has been transported hereunder to destination is refused by consignee or party entitled to receive it, or said consignee or party entitled to receive it shall fail to receive it promptly, the carrier may, in its discretion, to prevent deterioration or further deterioration, sell the same to the best advantage at private or public sale: Provided, That if time serves for notification to the consignor or owner of the refusal of the property or the failure to receive it and request for disposition of the property, such notification shall be given, in such manner as the exercise of due diligence requires, before the property is sold.

(d) Where the procedure provided for in the two paragraphs last preceding is not possible, it is agreed that nothing contained in said paragraphs shall be construed to abridge the right of the carrier at its option to sell the property under such circumstances and in such manner as may be authorized by law.

(e) The proceeds of any sale made under this section shall be applied by the carrier to the payment of freight, demurrage, storage, and any other lawful charges and the expense of notice, advertisement, sale, and other necessary expense and of caring for and maintaining the property, if proper care of the same requires special expense, and should there be a balance it shall be paid to the owner of the property sold hereunder.

(f) Property destined to or taken from a station, wharf, or landing at which there is no regularly appointed freight agent shall be entirely at risk of owner after unloaded from cars or vessels or until loaded into cars or vessels, and, except in case of carrier's negligence, when received from or delivered to such stations, wharves, or landings shall be at owner's risk until the cars are attached to and after they are detached from locomotive or train or until loaded into and after unloaded from vessels.

Sec. 5. No carrier hereunder will carry or be liable in any way for any documents, specie, or for any articles of extraordinary value not specifically rated in the published classifications or tariffs unless a special agreement to do so and a stipulated value of the articles are indorsed hereon.

Sec. 6. Every party, whether principal or agent, shipping explosives or dangerous goods, without previous full written disclosure to the carrier of their nature, shall be liable for and indemnify the carrier against all loss or damage caused by such goods, and such goods may be warehoused at owner's risk and expense or destroyed without compensation.

Sec. 7. The owner or consignee shall pay the freight and average, if any, and all other lawful charges accruing on said property; but, except in those instances where it may lawfully be authorized to do so, no carrier by railroad shall deliver or relinquish possession at destination of the property covered by this bill of lading until all tariff rates and charges thereon have been paid. The consignor shall be liable for the freight and all other lawful charges, except that if the consignor stipulates, by signature, in the space provided for that purpose on the face of this bill of lading that the carrier shall not make delivery without requiring payment of such charges and the carrier, contrary to such stipulation, shall make delivery without requiring such payment, the consignor (except as hereinafter provided) shall not be liable for such charges. Provided, that, where the carrier has been instructed by the shipper or consignor to deliver said property to a consignee other than the shipper or consignor, such consignee shall not be legally liable for transportation charges in respect of the transportation of said property (beyond those billed against him at the time of delivery for which he is otherwise liable) which may be found to be due after the property has been delivered to him, if the consignee (a) is an agent only and has no beneficial title in said property, and (b) prior to delivery of said property has notified the delivering carrier in writing of the fact of such agency and absence of beneficial title, and, in the case of a shipment reconsigned or diverted to a point other than that specified in the original bill of lading, has also notified the delivering carrier in writing of the name and address of the beneficial owner of said property; and, in such cases the shipper or consignor, or, in the case of a shipment so reconsigned or diverted, the beneficial owner, shall be liable for such additional charges. If the consignee has given to the carrier erroneous information as to who the beneficial owner is, such consignee shall himself be liable for such additional charges. On shipments reconsigned or diverted by an agent who has furnished the carrier in the reconsignment or diversion order with a notice of agency and the proper name and address of the beneficial owner, and where such shipments are refused or abandoned at ultimate destination, the said beneficial owner shall be liable for all legally applicable charges in connection therewith. If the reconsignor or diverter has given to the carrier erroneous information as to who the beneficial owner is, such reconsignor or diverter shall himself be liable for all such charges.

If a shipper or consignor of a shipment of property (other than a prepaid shipment) is also the consignee named in the bill of lading and, prior to the time of delivery, notifies, in writing, a delivering carrier by railroad (a) to deliver such property at destination to another party, (b) that such party is the beneficial owner of such property, and (c) that delivery is to be made to such party only upon payment of all transportation charges in respect of the transportation of such property, and delivery is made by the carrier to such party without such payment, such shipper or consignor shall not be liable (as shipper, consignor, consignee, or otherwise) for such transportation charges but the party to whom delivery is so made shall in any event be liable for transportation charges billed against the property at the time of such delivery, and also for any additional charges which may be found to be due after delivery of the property, except that if such party prior to such delivery has notified in writing the delivering carrier that he is not the beneficial owner of the property, and has given in writing to such delivering carrier the name and address of such beneficial owner, such party shall not be liable for any additional charges which may be found to be due after delivery of the property; but if the party to whom delivery is made has given to the carrier erroneous information as to the beneficial owner, such party shall nevertheless be liable for such additional charges. If the shipper or consignor has given to the delivering carrier erroneous information as to who the beneficial owner is, such shipper or consignor shall himself be liable for such transportation charges, notwithstanding the foregoing provisions of this paragraph and irrespective of any provisions to the contrary in the bill of lading or in the contract of transportation under which the shipment was made. The term "delivering carrier" means the line-haul carrier making ultimate delivery.

Nothing herein shall limit the right of the carrier to require at time of shipment the prepayment or guarantee of the charges. If upon inspection it is ascertained that the articles shipped are not those described in this bill of lading, the freight charges must be paid upon the articles actually shipped.

Where delivery is made by a common carrier by water the foregoing provisions of this section shall apply, except as may be inconsistent with Part III of the Interstate Commerce Act.

Sec. 8. If this bill of lading is issued on the order of the shipper, or his agent, in exchange or in substitution for another bill of lading, the shipper's signature to the prior bill of lading as to the statement of value or otherwise, or election of common law or bill of lading liability, in or in connection with such prior bill of lading, shall be considered a part of this bill of lading as fully as if the same were written or made in or in connection with this bill of lading.

Sec. 9. (a) If all or any part of said property is carried by water over any part of said route, and loss, damage or injury to said property occurs while the same is in the custody of a carrier by water the liability of such carrier shall be determined by the bill of lading of the carrier by water (this bill of lading being such bill of lading if the property is transported by such water carrier thereunder) and by and under the laws and regulations applicable to transportation by water. Such water carriage shall be performed subject to all the terms and provisions of, and all the exemptions from liability contained in the Act of the Congress of the United States, approved on February 13, 1893, and entitled "An act relating to the navigation of vessels, etc.," and of other statutes of the United States according carriers by water the protection of limited liability, as well as the following subdivisions of this section; and to the conditions contained in this bill of lading not inconsistent with this section, when this bill of lading becomes the bill of lading of the carrier by water.

(b) No such carrier by water shall be liable for any loss or damage resulting from any fire happening to or on board the vessel, or from explosion, bursting of boilers or breakage of shafts, unless caused by the design or neglect of such carrier.

(c) If the owner shall have exercised due diligence in making the vessel in all respects seaworthy and properly manned, equipped, and supplied, no such carrier shall be liable for any loss or damage resulting from the perils of the lakes, seas, or other waters, or from latent defects in hull, machinery, or appurtenances whether existing prior to, at the time of, or after sailing, or from collision, stranding, or other accidents of navigation, or from prolongation of the voyage. And, when for any reason it is necessary, any vessel carrying any or all of the property herein described shall be at liberty to call at any port or ports, in or out of the customary route, to tow and be towed, to transfer, trans-ship, or lighter, to load and discharge goods at any time, to assist vessels in distress, to deviate for the purpose of saving life or property, and for docking and repairs. Except in case of negligence such carrier shall not be responsible for any loss or damage to property if it be necessary or is usual to carry the same upon deck.

(d) General Average shall be payable according to the York-Antwerp Rules of 1924, Sections 1 to 15, inclusive, and Sections 17 to 22, inclusive, and as to matters not covered thereby according to the laws and usages of the Port of New York. If the owners shall have exercised due diligence to make the vessel in all respects seaworthy and properly manned, equipped and supplied, it is hereby agreed that in case of danger, damage or disaster resulting from faults or errors in navigation, or in the management of the vessel, or from any latent or other defects in the vessel, her machinery or appurtenances, or from unseaworthiness, whether existing at the time of shipment or at the beginning of the voyage (provided the latent or other defects or the unseaworthiness was not discoverable by the exercise of due diligence), the shippers, consignees and/or owners of the cargo shall nevertheless pay salvage and any special charges incurred in respect of the cargo, and shall contribute with the shipowner in general average to the payment of any sacrifices, losses or expenses of a general average nature that may be made or incurred for the common benefit or to relieve the adventure from any common peril.

(e) If the property is being carried under a tariff which provides that any carrier or carriers party thereto shall be liable for loss from perils of the sea, then as to such carrier or carriers the provisions of this section shall be modified in accordance with the tariff provisions, which shall be regarded as incorporated into the conditions of this bill of lading.

(f) The term "water carriage" in this section shall not be construed as including lighterage in or across rivers, harbors, or lakes, when performed by or on behalf of rail carriers.

Sec. 10. Any alteration, addition, or erasure in this bill of lading which shall be made without the special notation hereon of the agent of the carrier issuing this bill of lading, shall be without effect, and this bill of lading shall be enforceable according to its original tenor.

CAPCO KIN 0000408

300M 12-62

Form 3508

(For use in connection with Uniform Domestic Straight Bill of Lading, adopted by Carriers in Official, Southern, Western and Illinois Classification Territories, March 15, 1922, as amended August 1, 1930, and June 15, 1941.)

3rd SHEET

THIS MEMORANDUM is an acknowledgment that a bill of lading has been issued and is not the Original Bill of Lading nor a copy or duplicate covering the property named herein, and is intended solely for filing or record.

Shipper's No. B-15264

Agent's No.

Louisville & Nashville Railroad Company

RECEIVED, subject to the classifications and tariffs in effect on the date of the receipt by the carrier of the property described in the Original Bill of Lading,

at Mobile, Alabama (ASD) November 30th, 19 67

from Cement Asbestos Product Corp.

the property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below, which said company (the word company being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its own road or its own water line, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the conditions not prohibited by law, whether printed or written, herein contained, including the conditions on back hereof, which are hereby agreed to by the shipper and accepted for himself and his assigns.

(Mail or street address of consignee—For purposes of notification only.)

Consigned to Cement Asbestos Products Corp.

Destination Ragland State of Alabama County of

Route L&N - Sal

Delivering Carrier Car Initial SEE Car No. BELOW

No. Packages	DESCRIPTION OF ARTICLES, SPECIAL MARKS, AND EXCEPTIONS	*WEIGHT (Subject to Correction)	CLASS OR RATE	CHECK COLUMN
1986	Bags Blue Asbestos	~~105,600~~		
		202700		
	Ex S/S Reuben Tipton			
	W/R # 75 Durban 3			
L&N	98726 CONTAINS 705 BAGS - G 127300	T 54900	NET 72400	
	SEALS: 155565-66			
NYC	71480 CONTAINS 705 BAGS - G 128100	T 56700	NET 71400	
	SEALS: 155567-68			
CG	2638 CONTAINS 576 BAGS - G 119800	T 60900	NET 58900	
	SEALS: 155571-72			

Subject to Section 7 of conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:

The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

(Signature of Consignor.)

If charges are to be prepaid, write or stamp here, "To be Prepaid."

COLLECT

Received $ to apply in prepayment of the charges on the property described hereon.

Agent or Cashier.

(The signature here acknowledges only the amount prepaid.)

TERMINAL RAILWAY, ALA
STATE DOCKS, MOBILE, ALA.
Gross
Tare (Actual)
Tare (Marked)
No.
Length

RECEIVED
NOV 30 1967
L&N R.R. CO.
LOCAL FREIGHT OFFICE
MOBILE, ALA.

*If the shipment moves between two ports by a carrier by water, the law requires that the bill of lading shall state whether it is "carrier's or shipper's weight."

NOTE—Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.

The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

Charges Advanced:

Cement Asbestos Prod Corp. per

Ragland, Alabama Shipper. Hugh Justice, MCSA Agent

Per ASD (MW) Per

Permanent postoffice address of Shipper

CAPCO KIN 0000409

CONTRACT TERMS AND CONDITIONS

Sec. 1. (a) The carrier or party in possession of any of the property herein described shall be liable as at common law for any loss thereof or damage thereto, except as hereinafter provided.

(b) No carrier or party in possession of all or any of the property herein described shall be liable for any loss thereof or damage thereto or delay caused by the act of God, the public enemy, the authority of law, or the act or default of the shipper or owner, or for natural shrinkage. The carrier's liability shall be that of warehouseman, only, for loss, damage, or delay caused by fire occurring after the expiration of the free time allowed by tariffs lawfully on file (such free time to be computed as therein provided) after notice of the arrival of the property at destination or at the port of export (if intended for export) has been duly sent or given, and after placement of the property for delivery at destination, or tender of delivery of the property to the party entitled to receive it, has been made. Except in case of negligence of the carrier or party in possession (and the burden to prove freedom from such negligence shall be on the carrier or party in possession), the carrier or party in possession shall not be liable for loss, damage, or delay occurring while the property is stopped and held in transit upon the request of the shipper, owner, or party entitled to make such request, or resulting from a defect or vice in the property, or for country damage to cotton, or from riots or strikes.

(c) In case of quarantine the property may be discharged at risk and expense of owners into quarantine depot or elsewhere, as required by quarantine regulations or authorities, or for the carrier's dispatch at nearest available point in carrier's judgment, and in any such case carrier's responsibility shall cease when property is so discharged, or property may be returned by carrier at owner's expense to shipping point, earning freight both ways. Quarantine expenses of whatever nature or kind upon or in respect to property shall be borne by the owners of the property or be a lien thereon. The carrier shall not be liable for loss or damage occasioned by fumigation or disinfection or other acts required or done by quarantine regulations or authorities even though the same may have been done by carrier's officers, agents, or employees, nor for detention, loss, or damage of any kind occasioned by quarantine or the enforcement thereof. No carrier shall be liable, except in case of negligence, for any mistake or inaccuracy in any information furnished by the carrier, its agents, or officers, as to quarantine laws or regulations. The shipper shall hold the carriers harmless from any expense they may incur, or damages they may be required to pay, by reason of the introduction of the property covered by this contract into any place against the quarantine laws or regulations in effect at such place.

Sec. 2. (a) No carrier is bound to transport said property by any particular train or vessel, or in time for any particular market or otherwise than with reasonable dispatch. Every carrier shall have the right in case of physical necessity to forward said property by any carrier or route between the point of shipment and the point of destination. In all cases not prohibited by law, where a lower value than actual value has been represented in writing by the shipper or has been agreed upon in writing as the released value of the property as determined by the classification or tariffs upon which the rate is based, such lower value plus freight charges if paid shall be the maximum amount to be recovered, whether or not such loss or damage occurs from negligence.

(b) As a condition precedent to recovery, claims must be filed in writing with the receiving or delivering carrier, or carrier issuing this bill of lading, or carrier on whose line the loss, damage, injury or delay occurred, within nine months after delivery of the property (or, in case of export traffic, within nine months after delivery at port of export) or, in case of failure to make delivery, then within nine months after a reasonable time for delivery has elapsed; and suits shall be instituted against any carrier only within two years and one day from the day when notice in writing is given by the carrier to the claimant that the carrier has disallowed the claim or any part or parts thereof specified in the notice. Where claims are not filed or suits are not instituted thereon in accordance with the foregoing provisions, no carrier hereunder shall be liable, and such claims will not be paid.

(c) Any carrier or party liable on account of loss of or damage to any of said property shall have the full benefit of any insurance that may have been effected upon or on account of said property, so far as this shall not avoid the policies or contracts of insurance: Provided, That the carrier reimburse the claimant for the premium paid thereon.

Sec. 3. Except where such service is required as the result of carrier's negligence, all property shall be subject to necessary cooperage and baling at owner's cost. Each carrier over whose route cotton or cotton linters is to be transported hereunder shall have the privilege, at its own cost and risk, of compressing the same for greater convenience in handling or forwarding, and shall not be held responsible for deviation or unavoidable delays in procuring such compression. Grain in bulk consigned to a point where there is a railroad, public or licensed elevator, may (unless otherwise expressly noted herein, and then if it is not promptly unloaded) be there delivered and placed with other grain of the same kind and grade without respect to ownership (and prompt notice thereof shall be given to the consignor), and if so delivered shall be subject to a lien for elevator charges in addition to all other charges hereunder.

Sec. 4. (a) Property not removed by the party entitled to receive it within the free time allowed by tariffs, lawfully on file (such free time to be computed as therein provided), after notice of the arrival of the property at destination or at the port of export (if intended for export) has been duly sent or given, and after placement of the property for delivery at destination has been made, may be kept in vessel, car, depot, warehouse or place of delivery of the carrier, subject to the tariff charge for storage and to carrier's responsibility as warehouseman, only, or at the option of the carrier, may be removed to and stored in a public or licensed warehouse at the place of delivery or other available place, at the cost of the owner, and there held without liability on the part of the carrier, and subject to a lien for all freight and other lawful charges, including a reasonable charge for storage.

(b) Where nonperishable property which has been transported to destination hereunder is refused by consignee or the party entitled to receive it, or said consignee or party entitled to receive it fails to receive it within 15 days after notice of arrival shall have been duly sent or given, the carrier may sell the same at public auction to the highest bidder, at such place as may be designated by the carrier: Provided, That the carrier shall have first mailed, sent, or given to the consignor notice that the property has been refused or remains unclaimed, as the case may be, and that it will be subject to sale under the terms of the bill of lading if disposition be not arranged for, and shall have published notice containing a description of the property, the name of the party to whom consigned, or, if shipped order notify, the name of the party to be notified, and the time and place of sale, once a week for two successive weeks, in a newspaper of general circulation at the place of sale or nearest place where such newspaper is published: Provided, That 30 days shall have elapsed before publication of notice of sale after said notice that the property was refused or remains unclaimed was mailed, sent, or given.

(c) Where perishable property which has been transported hereunder to destination is refused by consignee or party entitled to receive it, or said consignee or party entitled to receive it shall fail to receive it promptly, the carrier may, in its discretion, to prevent deterioration or further deterioration, sell the same to the best advantage at private or public sale: Provided, That if time serves for notification to the consignor or owner of the refusal of the property or the failure to receive it and request for disposition of the property, such notification shall be given, in such manner as the exercise of due diligence requires, before the property is sold.

(d) Where the procedure provided for in the two paragraphs last preceding is not possible, it is agreed that nothing contained in said paragraphs shall be construed to abridge the right of the carrier at its option to sell the property under such circumstances and in such manner as may be authorized by law.

(e) The proceeds of any sale made under this section shall be applied by the carrier to the payment of freight, demurrage, storage, and any other lawful charges and the expense of notice, advertisement, sale, and other necessary expense and of caring for and maintaining the property, if proper care of the same requires special expense, and should there be a balance it shall be paid to the owner of the property sold hereunder.

(f) Property destined to or taken from a station, wharf, or landing at which there is no regularly appointed freight agent shall be entirely at risk of owner after unloaded from cars or vessels or until loaded into cars or vessels, and, except in case of carrier's negligence, when received from or delivered to such stations, wharves, or landings shall be at owner's risk until the cars are attached to and after they are detached from locomotive or train or until loaded into and after unloaded from vessels.

Sec. 5. No carrier hereunder will carry or be liable in any way for any documents, specie, or for any articles of extraordinary value not specifically rated in the published classifications or tariffs unless a special agreement to do so and a stipulated value of the articles are indorsed hereon.

(Revised June 15, 1941)

Sec. 6. Every party, whether principal or agent, shipping explosives or dangerous goods, without previous full written disclosure to the carrier of their nature, shall be liable for and indemnify the carrier against all loss or damage caused by such goods, and such goods may be warehoused at owner's risk and expense or destroyed without compensation.

Sec. 7. The owner or consignee shall pay the freight and average, if any, and all other lawful charges accruing on said property; but, except in those instances where it may lawfully be authorized to do so, no carrier by railroad shall deliver or relinquish possession at destination of the property covered by this bill of lading until all tariff rates and charges thereon have been paid. The consignor shall be liable for the freight and all other lawful charges, except that if the consignor stipulates, by signature, in the space provided for that purpose on the face of this bill of lading that the carrier shall not make delivery without requiring payment of such charges and the carrier, contrary to such stipulation, shall make delivery without requiring such payment, the consignor (except as hereinafter provided) shall not be liable for such charges. Provided, that, where the carrier has been instructed by the shipper or consignor to deliver said property to a consignee other than the shipper or consignor, such consignee shall not be legally liable for transportation charges in respect of the transportation of said property (beyond those billed against him at the time of delivery for which he is otherwise liable) which may be found to be due after the property has been delivered to him, if the consignee (a) is an agent only and has no beneficial title in said property, and (b) prior to delivery of said property has notified the delivering carrier in writing of the fact of such agency and absence of beneficial title, and, in the case of a shipment reconsigned or diverted to a point other than that specified in the original bill of lading, has also notified the delivering carrier in writing of the name and address of the beneficial owner of said property; and, in such cases the shipper or consignor, or, in the case of a shipment so reconsigned or diverted, the beneficial owner, shall be liable for such additional charges. If the consignee has given to the carrier erroneous information as to who the beneficial owner is, such consignee shall himself be liable for such additional charges. On shipments reconsigned or diverted by an agent who has furnished the carrier in the reconsignment or diversion order with a notice of agency and the proper name and address of the beneficial owner, and where such shipments are refused or abandoned at ultimate destination, the said beneficial owner shall be liable for all legally applicable charges in connection therewith. If the reconsignor or diverter has given to the carrier erroneous information as to who the beneficial owner is, such reconsignor or diverter shall himself be liable for all such charges.

If a shipper or consignor of a shipment of property (other than a prepaid shipment) is also the consignee named in the bill of lading and, prior to the time of delivery, notifies, in writing, a delivering carrier by railroad (a) to deliver such property at destination to another party, (b) that such party is the beneficial owner of such property, and (c) that delivery is to be made to such party only upon payment of all transportation charges in respect of the transportation of such property, and delivery is made by the carrier to such party without such payment, such shipper or consignor shall not be liable (as shipper, consignor, consignee, or otherwise) for such transportation charges but the party to whom delivery is so made shall in any event be liable for transportation charges billed against the property at the time of such delivery, and also for any additional charges which may be found to be due after delivery of the property, except that if such party prior to such delivery has notified in writing the delivering carrier that he is not the beneficial owner of the property, and has given in writing to such delivering carrier the name and address of such beneficial owner, such party shall not be liable for any additional charges which may be found to be due after delivery of the property; but if the party to whom delivery is made has given to the carrier erroneous information as to the beneficial owner, such party shall nevertheless be liable for such additional charges. If the shipper or consignor has given to the delivering carrier erroneous information as to who the beneficial owner is, such shipper or consignor shall himself be liable for such transportation charges, notwithstanding the foregoing provisions of this paragraph and irrespective of any provisions to the contrary in the bill of lading or in the contract of transportation under which the shipment was made. The term "delivering carrier" means the line-haul carrier making ultimate delivery.

Nothing herein shall limit the right of the carrier to require at time of shipment the prepayment or guarantee of the charges. If upon inspection it is ascertained that the articles shipped are not those described in this bill of lading, the freight charges must be paid upon the articles actually shipped.

Where delivery is made by a common carrier by water the foregoing provisions of this section shall apply, except as may be inconsistent with Part III of the Interstate Commerce Act.

Sec. 8. If this bill of lading is issued on the order of the shipper, or his agent, in exchange or in substitution for another bill of lading, the shipper's signature to the prior bill of lading as to the statement of value or otherwise, or election of common law or bill of lading liability, in or in connection with such prior bill of lading, shall be considered a part of this bill of lading as fully as if the same were written or made in or in connection with this bill of lading.

Sec. 9. (a) If all or any part of said property is carried by water over any part of said route, and loss, damage or injury to said property occurs while the same is in the custody of a carrier by water the liability of such carrier shall be determined by the bill of lading of the carrier by water (this bill of lading being such bill of lading if the property is transported by such water carrier thereunder) and by and under the laws and regulations applicable to transportation by water. Such water carriage shall be performed subject to all the terms and provisions of, and all the exemptions from liability contained in the Act of the Congress of the United States, approved on February 13, 1893, and entitled "An act relating to the navigation of vessels, etc.," and of other statutes of the United States according carriers by water the protection of limited liability, as well as the following subdivisions of this section; and to the conditions contained in this bill of lading not inconsistent with this section, when this bill of lading becomes the bill of lading of the carrier by water.

(b) No such carrier by water shall be liable for any loss or damage resulting from any fire happening to or on board the vessel, or from explosion, bursting of boilers or breakage of shafts, unless caused by the design or neglect of such carrier.

(c) If the owner shall have exercised due diligence in making the vessel in all respects seaworthy and properly manned, equipped, and supplied, no such carrier shall be liable for any loss or damage resulting from the perils of the lakes, seas, or other waters, or from latent defects in hull, machinery, or appurtenances whether existing prior to, at the time of, or after sailing, or from collision, stranding, or other accidents of navigation, or from prolongation of the voyage. And, when for any reason it is necessary, any vessel carrying any or all of the property herein described shall be at liberty to call at any port or ports, in or out of the customary route, to tow and be towed, to transfer, trans-ship, or lighter, to load and discharge goods at any time, to assist vessels in distress, to deviate for the purpose of saving life or property, and for docking and repairs. Except in case of negligence such carrier shall not be responsible for any loss or damage to property if it be necessary or is usual to carry the same upon deck.

(d) General Average shall be payable according to the York-Antwerp Rules of 1924, Sections 1 to 15, inclusive, and Sections 17 to 22, inclusive, and as to matters not covered thereby according to the laws and usages of the Port of New York. If the owners shall have exercised due diligence to make the vessel in all respects seaworthy and properly manned, equipped and supplied, it is hereby agreed that in case of danger, damage or disaster resulting from faults or errors in navigation, or in the management of the vessel, or from any latent or other defects in the vessel, her machinery or appurtenances, or from unseaworthiness, whether existing at the time of shipment or at the beginning of the voyage (provided the latent or other defects or the unseaworthiness was not discoverable by the exercise of due diligence), the shippers, consignees and/or owners of the cargo shall nevertheless pay salvage and any special charges incurred in respect of the cargo, and shall contribute with the shipowner in general average to the payment of any sacrifices, losses or expenses of a general average nature that may be made or incurred for the common benefit or to relieve the adventure from any common peril.

(e) If the property is being carried under a tariff which provides that any carrier or carriers party thereto shall be liable for loss from perils of the sea, then as to such carrier or carriers the provisions of this section shall be modified in accordance with the tariff provisions, which shall be regarded as incorporated into the conditions of this bill of lading.

(f) The term "water carriage" in this section shall not be construed as including lighterage in or across rivers, harbors, or lakes, when performed by or on behalf of rail carriers.

Sec. 10. Any alteration, addition, or erasure in this bill of lading which shall be made without the special notation hereon of the agent of the carrier issuing this bill of lading, shall be without effect, and this bill of lading shall be enforceable according to its original tenor.

CAPCO KIN 0000410

300M 12-62

Form 3508

(Uniform Domestic Straight Bill of Lading, adopted by Carriers in Official, Southern, Western and Illinois Classification Territories, March 15, 1922, as amended August 1, 1930 and June 15, 1941.)

1st SHEET

UNIFORM STRAIGHT BILL OF LADING

Shipper's No. R-15264

ORIGINAL—NOT NEGOTIABLE

Agent's No.

L&N

Louisville & Nashville Railroad Company

RECEIVED, subject to the classifications and tariffs in effect on the date of the issue of this Bill of Lading,

at Mobile, Alabama (ASD) November XXX 30th, 19 67

from Cement Asbestos Product Corp.

the property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below, which said company (the word company being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its own road or its own water line, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the conditions not prohibited by law, whether printed or written, herein contained, including the conditions on back hereof, which are hereby agreed to by the shipper and accepted for himself and his assigns.

(Mail or street address of consignee—For purposes of notification only.)

Consigned to Cement Asbestos Products Corp.

Destination Ragland State of Alabama County of

Route L&N - Sal

Delivering Carrier Car Initial SEE Car No. BELOW

No. Packages	DESCRIPTION OF ARTICLES, SPECIAL MARKS, AND EXCEPTIONS	*WEIGHT (Subject to Correction)	CLASS OR RATE	CHECK COLUMN
1986	Bags Blue Asbestos	~~195,500~~ 202700		
	Ex S/S Reuben Tipton W/R # 75 Durban 3			
L&N	98726 CONTAINS 705 BAGS - G 127300 T 54900 NET 72400 SEALS: 155565-66			
~~NYC~~	~~71480 CONTAINS 705 BAGS - G 128100 T 56700 NET 71400~~ SEALS: 155567-68			
CG	2638 CONTAINS 576 BAGS - G 119800 T 60900 NET 58900 SEALS: 155571-72			

TERMINAL RAILWAY, ALA.
STATE DOCKS, MOBILE, ALA.
Gross
Tare (Actual)
Tare (Marked)
Net
Capacity Length
AUTHORITY of S. W. and L. B.

Subject to Section 7 of conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:

The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

(Signature of Consignor.)

If charges are to be prepaid, write or stamp here, "To be Prepaid."

COLLECT

Received $ to apply in prepayment of the charges on the property described hereon.

Agent or Cashier.

Per

(The signature here acknowledges only the amount prepaid.)

Charges Advanced:

$

*If the shipment moves between two ports by a carrier by water, the law requires that the bill of lading shall state whether it is "carrier's or shipper's weight."

NOTE—Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.

The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

Cement Asbestos Prod Corp. per

Ragland, Alabama Shipper. Hugh Justicek MCSA Agent

Per ASD (SW) Per HWE

Permanent postoffice address of Shipper

RECEIVED NOV 30 1967 L.&N. R.R. CO. LOCAL TRAFFIC OFFICE MOBILE, ALA.

CAPCO KIN 0000411

CONTRACT TERMS AND CONDITIONS

Sec. 1. (a) The carrier or party in possession of any of the property herein described shall be liable as at common law for any loss thereof or damage thereto, except as hereinafter provided.

(b) No carrier or party in possession of all or any of the property herein described shall be liable for any loss thereof or damage thereto or delay caused by the act of God, the public enemy, the authority of law, or the act or default of the shipper or owner, or for natural shrinkage. The carrier's liability shall be that of warehouseman, only, for loss, damage, or delay caused by fire occurring after the expiration of the free time allowed by tariffs lawfully on file (such free time to be computed as therein provided) after notice of the arrival of the property at destination or at the port of export (if intended for export) has been duly sent or given, and after placement of the property for delivery at destination, or tender of delivery of the property to the party entitled to receive it, has been made. Except in case of negligence of the carrier or party in possession (and the burden to prove freedom from such negligence shall be on the carrier or party in possession), the carrier or party in possession shall not be liable for loss, damage, or delay occurring while the property is stopped and held in transit upon the request of the shipper, owner, or party entitled to make such request, or resulting from a defect or vice in the property, or for country damage to cotton, or from riots or strikes.

(c) In case of quarantine the property may be discharged at risk and expense of owners into quarantine depot or elsewhere, as required by quarantine regulations or authorities, or for the carrier's dispatch at nearest available point in carrier's judgment, and in any such case carrier's responsibility shall cease when property is so discharged, or property may be returned by carrier at owner's expense to shipping point, earning freight both ways. Quarantine expenses of whatever nature or kind upon or in respect to property shall be borne by the owners of the property or be a lien thereon. The carrier shall not be liable for loss or damage occasioned by fumigation or disinfection or other acts required or done by quarantine regulations or authorities even though the same may have been done by carrier's officers, agents, or employees, nor for detention, loss, or damage of any kind occasioned by quarantine or the enforcement thereof. No carrier shall be liable, except in case of negligence, for any mistake or inaccuracy in any information furnished by the carrier, its agents, or officers, as to quarantine laws or regulations. The shipper shall hold the carriers harmless from any expense they may incur, or damages they may be required to pay, by reason of the introduction of the property covered by this contract into any place against the quarantine laws or regulations in effect at such place.

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(b) Where nonperishable property which has been transported to destination hereunder is refused by consignee or the party entitled to receive it, or said consignee or party entitled to receive it fails to receive it within 15 days after notice of arrival shall have been duly sent or given, the carrier may sell the same at public auction to the highest bidder, at such place as may be designated by the carrier: Provided, That the carrier shall have first mailed, sent, or given to the consignor notice that the property has been refused or remains unclaimed, as the case may be, and that it will be subject to sale under the terms of the bill of lading if disposition be not arranged for, and shall have published notice containing a description of the property, the name of the party to whom consigned, or, if shipped order notify, the name of the party to be notified, and the time and place of sale, once a week for two successive weeks, in a newspaper of general circulation at the place of sale or nearest place where such newspaper is published: Provided, That 30 days shall have elapsed before publication of notice of sale after said notice that the property was refused or remains unclaimed was mailed, sent, or given.

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(d) Where the procedure provided for in the two paragraphs last preceding is not possible, it is agreed that nothing contained in said paragraphs shall be construed to abridge the right of the carrier at its option to sell the property under such circumstances and in such manner as may be authorised by law.

(e) The proceeds of any sale made under this section shall be applied by the carrier to the payment of freight, demurrage, storage, and any other lawful charges and the expense of notice, advertisement, sale, and other necessary expense and of caring for and maintaining the property, if proper care of the same requires special expense, and should there be a balance it shall be paid to the owner of the property sold hereunder.

(f) Property destined to or taken from a station, wharf, or landing at which there is no regularly appointed freight agent shall be entirely at risk of owner after unloaded from cars or vessels or until loaded into cars or vessels, and, except in case of carrier's negligence, when received from or delivered to such stations, wharves, or landings shall be at owner's risk until the cars are attached to and after they are detached from locomotive or train or until loaded into and after unloaded from vessels.

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Sec. 6. Every party, whether principal or agent, shipping explosives or dangerous goods, without previous full written disclosure to the carrier of their nature, shall be liable for and indemnify the carrier against all loss or damage caused by such goods, and such goods may be warehoused at owner's risk and expense or destroyed without compensation.

Sec. 7. The owner or consignee shall pay the freight and average, if any, and all other lawful charges accruing on said property; but, except in those instances where it may lawfully be authorized to do so, no carrier by railroad shall deliver or relinquish possession at destination of the property covered by this bill of lading until all tariff rates and charges thereon have been paid. The consignor shall be liable for the freight and all other lawful charges, except that if the consignor stipulates, by signature, in the space provided for that purpose on the face of this bill of lading that the carrier shall not make delivery without requiring payment of such charges and the carrier, contrary to such stipulation, shall make delivery without requiring such payment, the consignor (except as hereinafter provided) shall not be liable for such charges. Provided, that, where the carrier has been instructed by the shipper or consignor to deliver said property to a consignee other than the shipper or consignor, such consignee shall not be legally liable for transportation charges in respect of the transportation of said property (beyond those billed against him at the time of delivery for which he is otherwise liable) which may be found to be due after the property has been delivered to him, if the consignee (a) is an agent only and has no beneficial title in said property, and (b) prior to delivery of said property has notified the delivering carrier in writing of the fact of such agency and absence of beneficial title, and, in the case of a shipment reconsigned or diverted to a point other than that specified in the original bill of lading, has also notified the delivering carrier in writing of the name and address of the beneficial owner of said property; and, in such cases the shipper or consignor, or, in the case of a shipment so reconsigned or diverted, the beneficial owner, shall be liable for such additional charges. If the consignee has given to the carrier erroneous information as to who the beneficial owner is, such consignee shall himself be liable for such additional charges. On shipments reconsigned or diverted by an agent who has furnished the carrier in the reconsignment or diversion order with a notice of agency and the proper name and address of the beneficial owner, and where such shipments are refused or abandoned at ultimate destination, the said beneficial owner shall be liable for all legally applicable charges in connection therewith. If the reconsignor or diverter has given to the carrier erroneous information as to who the beneficial owner is, such reconsignor or diverter shall himself be liable for all such charges.

If a shipper or consignor of a shipment of property (other than a prepaid shipment) is also the consignee named in the bill of lading and, prior to the time of delivery, notifies, in writing, a delivering carrier by railroad (a) to deliver such property at destination to another party, (b) that such party is the beneficial owner of such property, and (c) that delivery is to be made to such party only upon payment of all transportation charges in respect of the transportation of such property, and delivery is made by the carrier to such party without such payment, such shipper or consignor shall not be liable (as shipper, consignor, consignee, or otherwise) for such transportation charges but the party to whom delivery is so made shall in any event be liable for transportation charges billed against the property at the time of such delivery, and also for any additional charges which may be found to be due after delivery of the property, except that if such party prior to such delivery has notified in writing the delivering carrier that he is not the beneficial owner of the property, and has given in writing to such delivering carrier the name and address of such beneficial owner, such party shall not be liable for any additional charges which may be found to be due after delivery of the property; but if the party to whom delivery is made has given to the carrier erroneous information as to the beneficial owner, such party shall nevertheless be liable for such additional charges. If the shipper or consignor has given to the delivering carrier erroneous information as to who the beneficial owner is, such shipper or consignor shall himself be liable for such transportation charges, notwithstanding the foregoing provisions of this paragraph and irrespective of any provisions to the contrary in the bill of lading or in the contract of transportation under which the shipment was made. The term "delivering carrier" means the line-haul carrier making ultimate delivery.

Nothing herein shall limit the right of the carrier to require at time of shipment the prepayment or guarantee of the charges. If upon inspection it is ascertained that the articles shipped are not those described in this bill of lading, the freight charges must be paid upon the articles actually shipped.

Where delivery is made by a common carrier by water the foregoing provisions of this section shall apply, except as may be inconsistent with Part III of the Interstate Commerce Act.

Sec. 8. If this bill of lading is issued on the order of the shipper, or his agent, in exchange or in substitution for another bill of lading, the shipper's signature to the prior bill of lading as to the statement of value or otherwise, or election of common law or bill of lading liability, in or in connection with such prior bill of lading, shall be considered a part of this bill of lading as fully as if the same were written or made in or in connection with this bill of lading.

Sec. 9. (a) If all or any part of said property is carried by water over any part of said route, and loss, damage or injury to said property occurs while the same is in the custody of a carrier by water the liability of such carrier shall be determined by the bill of lading of the carrier by water (this bill of lading being such bill of lading if the property is transported by such water carrier thereunder) and by and under the laws and regulations applicable to transportation by water. Such water carriage shall be performed subject to all the terms and provisions of and all the exemptions from liability contained in the Act of the Congress of the United States, approved on February 13, 1893, and entitled "An act relating to the navigation of vessels, etc.," and of other statutes of the United States according carriers by water the protection of limited liability, as well as the following subdivisions of this section; and to the conditions contained in this bill of lading not inconsistent with this section, when this bill of lading becomes the bill of lading of the carrier by water.

(b) No such carrier by water shall be liable for any loss or damage resulting from any fire happening to or on board the vessel, or from explosion, bursting of boilers or breakage of shafts, unless caused by the design or neglect of such carrier.

(c) If the owner shall have exercised due diligence in making the vessel in all respects seaworthy and properly manned, equipped, and supplied, no such carrier shall be liable for any loss or damage resulting from the perils of the lakes, seas, or other waters, or from latent defects in hull, machinery, or appurtenances whether existing prior to, at the time of, or after sailing, or from collision, stranding, or other accidents of navigation, or from prolongation of the voyage. And, when for any reason it is necessary, any vessel carrying any or all of the property herein described shall be at liberty to call at any port or ports, in or out of the customary route, to tow and be towed, to transfer, trans-ship, or lighter, to load and discharge goods at any time, to assist vessels in distress, to deviate for the purpose of saving life or property, and for docking and repairs. Except in case of negligence such carrier shall not be responsible for any loss or damage to property if it be necessary or is usual to carry the same upon deck.

(d) General Average shall be payable according to the York-Antwerp Rules of 1924, Sections 1 to 15, inclusive, and Sections 17 to 22, inclusive, and as to matters not covered thereby according to the laws and usages of the Port of New York. If the owners shall have exercised due diligence to make the vessel in all respects seaworthy and properly manned, equipped and supplied, it is hereby agreed that in case of danger, damage or disaster resulting from faults or errors in navigation, or in the management of the vessel, or from any latent or other defects in the vessel, her machinery or appurtenances, or from unseaworthiness, whether existing at the time of shipment or at the beginning of the voyage (provided the latent or other defects or the unseaworthiness was not discoverable by the exercise of due diligence), the shippers, consignees and/or owners of the cargo shall nevertheless pay salvage and any special charges incurred in respect of the cargo, and shall contribute with the shipowner in general average to the payment of any sacrifices, losses or expenses of a general average nature that may be made or incurred for the common benefit or to relieve the adventure from any common peril.

(e) If the property is being carried under a tariff which provides that any carrier or carriers party thereto shall be liable for loss from perils of the sea, then as to such carrier or carriers the provisions of this section shall be modified in accordance with the tariff provisions, which shall be regarded as incorporated into the conditions of this bill of lading.

(f) The term "water carriage" in this section shall not be construed as including lighterage in or across rivers, harbors, or lakes, when performed by or on behalf of rail carriers.

Sec. 10. Any alteration, addition, or erasure in this bill of lading which shall be made without the special notation hereon of the agent of the carrier issuing this bill of lading, shall be without effect, and this bill of lading shall be enforceable according to its original tenor.

(Revised June 15, 1941)

CAPCO KIN 0000412

300M 12-62 AMB

Form 3508

(For use in connection with Uniform Domestic Straight Bill of Lading, adopted by Carriers in Official, Southern, Western and Illinois Classification Territories, March 15, 1922, as amended August 1, 1930, and June 15, 1941.)

2nd SHEET

Shipper's No. R-15264

Agent's No.

L&N

THIS SHIPPING ORDER must be legibly filled in, in ink, in indelible pencil, or in carbon and retained by the Agent.

Louisville & Nashville Railroad Company

RECEIVE, subject to the classifications and tariffs in effect on the date of the issue of this Shipping Order,

at Mobile, Alabama (ASD) November 30th, 1967

from Cement Asbestos Product Corp.

the property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below, which said company (the word company being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its own road or its own water line, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the conditions not prohibited by law, whether printed or written, herein contained, including the conditions on back hereof, which are hereby agreed to by the shipper and accepted for himself and his assigns.

(Mail or street address of consignee—For purposes of notification only.)

Consigned to Cement Asbestos Products Corp.

Destination Ragland State of Alabama County of

Route L&N - Sal

Delivering Carrier Car Initial SEE Car No. BELOW

No. Packages	DESCRIPTION OF ARTICLES, SPECIAL MARKS, AND EXCEPTIONS	*WEIGHT (Subject to Correction)	CLASS OR RATE	CHECK COLUMN
198	Raga Blue Asbestos	~~[illegible]~~		
		202700		
	Ex S/S Reuben Tipton			
	[illegible]			
L&N	98726 CONTAINS 705 BAGS - G 127300 T 54900 NET 72400			
	SEALS: 155565-66			
NYC	71480 CONTAINS 705 BAGS - G 128100 T 56700 NET 71400			
	SEALS: 155567-68			
CG	2638 CONTAINS 576 BAGS - G 119800 T 60900 NET 58900			
	SEALS: 155571-72			

TERMINAL RAILWAY, ALA
STATE DOCK
Gross
Tare (Actual)
Tare (Estimated)
Net
Capacity Length

Subject to Section 7 of conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:

The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

(Signature of Consignor.)

If charges are to be prepaid, write or stamp here, "To be Prepaid."

COLLECT

Received $ to apply in prepayment of the charges on the property described hereon.

Agent or Cashier.

Per

(The signature here acknowledges only the amount prepaid.)

Charges Advanced:

RECEIVED NOV 30 1967 L&N R.R. CO. ECONOMIC DEPARTMENT OFFICE MOBILE, ALA.

*If the shipment moves between two ports by a carrier by water, the law requires that the bill of lading shall state whether it is "carrier's or shipper's weight."

NOTE—Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.

The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

Cement Asbestos Prod Corp. per

Ragland, Alabama Shipper.

Per ASD (SE)

Hugh Justice, Mgr.

☞ Agent must detach and retain this Shipping Order and must sign the Original Bill of Lading

Permanent postoffice address of Shipper

CAPCO KIN 0000413

CONTRACT TERMS AND CONDITIONS

Sec. 1. (a) The carrier or party in possession of any of the property herein described shall be liable as at common law for any loss thereof or damage thereto, except as hereinafter provided.

(b) No carrier or party in possession of all or any of the property herein described shall be liable for any loss thereof or damage thereto or delay caused by the act of God, the public enemy, the authority of law, or the act or default of the shipper or owner, or for natural shrinkage. The carrier's liability shall be that of warehouseman, only, for loss, damage, or delay caused by fire occurring after the expiration of the free time allowed by tariffs lawfully on file (such free time to be computed as therein provided) after notice of the arrival of the property at destination or at the port of export (if intended for export) has been duly sent or given, and after placement of the property for delivery at destination, or tender of delivery of the property to the party entitled to receive it, has been made. Except in case of negligence of the carrier or party in possession (and the burden to prove freedom from such negligence shall be on the carrier or party in possession), the carrier or party in possession shall not be liable for loss, damage, or delay occurring while the property is stopped and held in transit upon the request of the shipper, owner, or party entitled to make such request, or resulting from a defect or vice in the property, or for country damage to cotton, or from riots or strikes.

(c) In case of quarantine the property may be discharged at risk and expense of owners into quarantine depot or elsewhere, as required by quarantine regulations or authorities, or for the carrier's dispatch at nearest available point in carrier's judgment, and in any such case carrier's responsibility shall cease when property is so discharged, or property may be returned by carrier at owner's expense to shipping point, earning freight both ways. Quarantine expenses of whatever nature or kind upon or in respect to property shall be borne by the owners of the property or be a lien thereon. The carrier shall not be liable for loss or damage occasioned by fumigation or disinfection or other acts required or done by quarantine regulations or authorities even though the same may have been done by carrier's officers, agents, or employees, nor for detention, loss, or damage of any kind occasioned by quarantine or the enforcement thereof. No carrier shall be liable, except in case of negligence, for any mistake or inaccuracy in any information furnished by the carrier, its agents, or officers, as to quarantine laws or regulations. The shipper shall hold the carriers harmless from any expense they may incur, or damages they may be required to pay, by reason of the introduction of the property covered by this contract into any place against the quarantine laws or regulations in effect at such place.

Sec. 2. (a) No carrier is bound to transport said property by any particular train or vessel, or in time for any particular market or otherwise than with reasonable dispatch. Every carrier shall have the right in case of physical necessity to forward said property by any carrier or route between the point of shipment and the point of destination. In all cases not prohibited by law, where a lower value than actual value has been represented in writing by the shipper or has been agreed upon in writing as the released value of the property as determined by the classification or tariffs upon which the rate is based, such lower value plus freight charges if paid shall be the maximum amount to be recovered, whether or not such loss or damage occurs from negligence.

(b) As a condition precedent to recovery, claims must be filed in writing with the receiving or delivering carrier, or carrier issuing this bill of lading, or carrier on whose line the loss, damage, injury or delay occurred, within nine months after delivery of the property (or, in case of export traffic, within nine months after delivery at port of export) or, in case of failure to make delivery, then within nine months after a reasonable time for delivery has elapsed; and suits shall be instituted against any carrier only within two years and one day from the day when notice in writing is given by the carrier to the claimant that the carrier has disallowed the claim or any part or parts thereof specified in the notice. Where claims are not filed or suits are not instituted thereon in accordance with the foregoing provisions, no carrier hereunder shall be liable, and such claims will not be paid.

(c) Any carrier or party liable on account of loss of or damage to any of said property shall have the full benefit of any insurance that may have been effected upon or on account of said property, so far as this shall not avoid the policies or contracts of insurance: Provided, That the carrier reimburse the claimant for the premium paid thereon.

Sec. 3. Except where such service is required as the result of carrier's negligence, all property shall be subject to necessary cooperage and baling at owner's cost. Each carrier over whose route cotton or cotton linters is to be transported hereunder shall have the privilege, at its own cost and risk, of compressing the same for greater convenience in handling or forwarding, and shall not be held responsible for deviation or unavoidable delays in procuring such compression. Grain in bulk consigned to a point where there is a railroad, public or licensed elevator, may (unless otherwise expressly noted herein, and then if it is not promptly unloaded) be there delivered and placed with other grain of the same kind and grade without respect to ownership (and prompt notice thereof shall be given to the consignor), and if so delivered shall be subject to a lien for elevator charges in addition to all other charges hereunder.

Sec. 4. (a) Property not removed by the party entitled to receive it within the free time allowed by tariffs, lawfully on file (such free time to be computed as therein provided), after notice of the arrival of the property at destination or at the port of export (if intended for export) has been duly sent or given, and after placement of the property for delivery at destination has been made, may be kept in vessel, car, depot, warehouse or place of delivery of the carrier, subject to the tariff charge for storage and to carrier's responsibility as warehouseman, only, or at the option of the carrier, may be removed to and stored in a public or licensed warehouse at the place of delivery or other available place, at the cost of the owner, and there held without liability on the part of the carrier, and subject to a lien for all freight and other lawful charges, including a reasonable charge for storage.

(b) Where nonperishable property which has been transported to destination hereunder is refused by consignee or the party entitled to receive it, or said consignee or party entitled to receive it fails to receive it within 15 days after notice of arrival shall have been duly sent or given, the carrier may sell the same at public auction to the highest bidder, at such place as may be designated by the carrier: Provided, That the carrier shall have first mailed, sent, or given to the consignor notice that the property has been refused or remains unclaimed, as the case may be, and that it will be subject to sale under the terms of the bill of lading if disposition be not arranged for, and shall have published notice containing a description of the property, the name of the party to whom consigned, or, if shipped order notify, the name of the party to be notified, and the time and place of sale, once a week for two successive weeks, in a newspaper of general circulation at the place of sale or nearest place where such newspaper is published: Provided, That 30 days shall have elapsed before publication of notice of sale after said notice that the property was refused or remains unclaimed was mailed, sent, or given.

(c) Where perishable property which has been transported hereunder to destination is refused by consignee or party entitled to receive it, or said consignee or party entitled to receive it shall fail to receive it promptly, the carrier may, in its discretion, to prevent deterioration or further deterioration, sell the same to the best advantage at private or public sale: Provided, That if time serves for notification to the consignor or owner of the refusal of the property or the failure to receive it and request for disposition of the property, such notification shall be given, in such manner as the exercise of due diligence requires, before the property is sold.

(d) Where the procedure provided for in the two paragraphs last preceding is not possible, it is agreed that nothing contained in said paragraphs shall be construed to abridge the right of the carrier at its option to sell the property under such circumstances and in such manner as may be authorized by law.

(e) The proceeds of any sale made under this section shall be applied by the carrier to the payment of freight, demurrage, storage, and any other lawful charges and the expense of notice, advertisement, sale, and other necessary expense and of caring for and maintaining the property, if proper care of the same requires special expense, and should there be a balance it shall be paid to the owner of the property sold hereunder.

(f) Property destined to or taken from a station, wharf, or landing at which there is no regularly appointed freight agent shall be entirely at risk of owner after unloaded from cars or vessels or until loaded into cars or vessels, and, except in case of carrier's negligence, when received from or delivered to such stations, wharves, or landings shall be at owner's risk until the cars are attached to and after they are detached from locomotive or train or until loaded into and after unloaded from vessels.

Sec. 5. No carrier hereunder will carry or be liable in any way for any documents, specie, or for any articles of extraordinary value not specifically rated in the published classifications or tariffs unless a special agreement to do so and a stipulated value of the articles are indorsed hereon.

(Revised June 15, 1941)

Sec. 6. Every party, whether principal or agent, shipping explosives or dangerous goods, without previous full written disclosure to the carrier of their nature, shall be liable for and indemnify the carrier against all loss or damage caused by such goods, and such goods may be warehoused at owner's risk and expense or destroyed without compensation.

Sec. 7. The owner or consignee shall pay the freight and average, if any, and all other lawful charges accruing on said property; but, except in those instances where it may lawfully be authorized to do so, no carrier by railroad shall deliver or relinquish possession at destination of the property covered by this bill of lading until all tariff rates and charges thereon have been paid. The consignor shall be liable for the freight and all other lawful charges, except that if the consignor stipulates, by signature, in the space provided for that purpose on the face of this bill of lading that the carrier shall not make delivery without requiring payment of such charges and the carrier, contrary to such stipulation, shall make delivery without requiring such payment, the consignor (except as hereinafter provided) shall not be liable for such charges. Provided, that, where the carrier has been instructed by the shipper or consignor to deliver said property to a consignee other than the shipper or consignor, such consignee shall not be legally liable for transportation charges in respect of the transportation of said property (beyond those billed against him at the time of delivery for which he is otherwise liable) which may be found to be due after the property has been delivered to him, if the consignee (a) is an agent only and has no beneficial title in said property, and (b) prior to delivery of said property has notified the delivering carrier in writing of the fact of such agency and absence of beneficial title, and, in the case of a shipment reconsigned or diverted to a point other than that specified in the original bill of lading, has also notified the delivering carrier in writing of the name and address of the beneficial owner of said property; and, in such cases the shipper or consignor, or, in the case of a shipment so reconsigned or diverted, the beneficial owner, shall be liable for such additional charges. If the consignee has given to the carrier erroneous information as to who the beneficial owner is, such consignee shall himself be liable for such additional charges. On shipments reconsigned or diverted by an agent who has furnished the carrier in the reconsignment or diversion order with a notice of agency and the proper name and address of the beneficial owner, and where such shipments are refused or abandoned at ultimate destination, the said beneficial owner shall be liable for all legally applicable charges in connection therewith. If the reconsignor or diverter has given to the carrier erroneous information as to who the beneficial owner is, such reconsignor or diverter shall himself be liable for all such charges.

If a shipper or consignor of a shipment of property (other than a prepaid shipment) is also the consignee named in the bill of lading and, prior to the time of delivery, notifies, in writing, a delivering carrier by railroad (a) to deliver such property at destination to another party, (b) that such party is the beneficial owner of such property, and (c) that delivery is to be made to such party only upon payment of all transportation charges in respect of the transportation of such property, and delivery is made by the carrier to such party without such payment, such shipper or consignor shall not be liable (as shipper, consignor, consignee, or otherwise) for such transportation charges but the party to whom delivery is so made shall in any event be liable for transportation charges billed against the property at the time of such delivery, and also for any additional charges which may be found to be due after delivery of the property, except that if such party prior to such delivery has notified in writing the delivering carrier that he is not the beneficial owner of the property, and has given in writing to such delivering carrier the name and address of such beneficial owner, such party shall not be liable for any additional charges which may be found to be due after delivery of the property; but if the party to whom delivery is made has given to the carrier erroneous information as to the beneficial owner, such party shall nevertheless be liable for such additional charges. If the shipper or consignor has given to the delivering carrier erroneous information as to who the beneficial owner is, such shipper or consignor shall himself be liable for such transportation charges, notwithstanding the foregoing provisions of this paragraph and irrespective of any provisions to the contrary in the bill of lading or in the contract of transportation under which the shipment was made. The term "delivering carrier" means the line-haul carrier making ultimate delivery.

Nothing herein shall limit the right of the carrier to require at time of shipment the prepayment or guarantee of the charges. If upon inspection it is ascertained that the articles shipped are not those described in this bill of lading, the freight charges must be paid upon the articles actually shipped.

Where delivery is made by a common carrier by water the foregoing provisions of this section shall apply, except as may be inconsistent with Part III of the Interstate Commerce Act.

Sec. 8. If this bill of lading is issued on the order of the shipper, or his agent, in exchange or in substitution for another bill of lading, the shipper's signature to the prior bill of lading as to the statement of value or otherwise, or election of common law or bill of lading liability, in or in connection with such prior bill of lading, shall be considered a part of this bill of lading as fully as if the same were written or made in or in connection with this bill of lading.

Sec. 9. (a) If all or any part of said property is carried by water over any part of said route, and loss, damage or injury to said property occurs while the same is in the custody of a carrier by water the liability of such carrier shall be determined by the bill of lading of the carrier by water (this bill of lading being such bill of lading if the property is transported by such water carrier thereunder) and by and under the laws and regulations applicable to transportation by water. Such water carriage shall be performed subject to all the terms and provisions of, and all the exemptions from liability contained in the Act of the Congress of the United States, approved on February 13, 1893, and entitled "An act relating to the navigation of vessels, etc.," and of other statutes of the United States according carriers by water the protection of limited liability, as well as the following subdivisions of this section; and to the conditions contained in this bill of lading not inconsistent with this section, when this bill of lading becomes the bill of lading of the carrier by water.

(b) No such carrier by water shall be liable for any loss or damage resulting from any fire happening to or on board the vessel, or from explosion, bursting of boilers or breakage of shafts, unless caused by the design or neglect of such carrier.

(c) If the owner shall have exercised due diligence in making the vessel in all respects seaworthy and properly manned, equipped, and supplied, no such carrier shall be liable for any loss or damage resulting from the perils of the lakes, seas, or other waters, or from latent defects in hull, machinery, or appurtenances whether existing prior to, at the time of, or after sailing, or from collision, stranding, or other accidents of navigation, or from prolongation of the voyage. And, when for any reason it is necessary, any vessel carrying any or all of the property herein described shall be at liberty to call at any port or ports, in or out of the customary route, to tow and be towed, to transfer, trans-ship, or lighter, to load and discharge goods at any time, to assist vessels in distress, to deviate for the purpose of saving life or property, and for docking and repairs. Except in case of negligence such carrier shall not be responsible for any loss or damage to property if it be necessary or is usual to carry the same upon deck.

(d) General Average shall be payable according to the York-Antwerp Rules of 1924, Sections 1 to 15, inclusive, and Sections 17 to 22, inclusive, and as to matters not covered thereby according to the laws and usages of the Port of New York. If the owners shall have exercised due diligence to make the vessel in all respects seaworthy and properly manned, equipped and supplied, it is hereby agreed that in case of danger, damage or disaster resulting from faults or errors in navigation, or in the management of the vessel, or from any latent or other defects in the vessel, her machinery or appurtenances, or from unseaworthiness, whether existing at the time of shipment or at the beginning of the voyage (provided the latent or other defects or the unseaworthiness was not discoverable by the exercise of due diligence), the shippers, consignees and/or owners of the cargo shall nevertheless pay salvage and any special charges incurred in respect of the cargo, and shall contribute with the shipowner in general average to the payment of any sacrifices, losses or expenses of a general average nature that may be made or incurred for the common benefit or to relieve the adventure from any common peril.

(e) If the property is being carried under a tariff which provides that any carrier or carriers party thereto shall be liable for loss from perils of the sea, then as to such carrier or carriers the provisions of this section shall be modified in accordance with the tariff provisions, which shall be regarded as incorporated into the conditions of this bill of lading.

(f) The term "water carriage" in this section shall not be construed as including lighterage in or across rivers, harbors, or lakes, when performed by or on behalf of rail carriers.

Sec. 10. Any alteration, addition, or erasure in this bill of lading which shall be made without the special notation hereon of the agent of the carrier issuing this bill of lading, shall be without effect, and this bill of lading shall be enforceable according to its original tenor.

CAPCO KIN 0000414

ARRIVAL NOTICE AND COPY OF BILL FOR PAYMENT OF FREIGHT CHARGES

FORM 7-A

TO SEABOARD AIR LINE RAILROAD COMPANY, HAS RECEIVED THE FOLLOWING ARTICLES CONSIGNED TO YOU

Ragland, Ala. STATION Dec. 8, 1967 19

CONSIGNEE Cement Asbestos Products Co. FREIGHT BILL NO. 1150

ROUTE (POINT OF ORIGIN TO DESTINATION) L&N Bhan. SCL

WAYBILLED FROM	WAYBILL DATE AND NUMBER	FULL NAME OF SHIPPER	CAR INITIAL AND NUMBER
Mobile, Ala.	11-30-67 129534	Cement Asbestos Products Co.	(See Below)
POINT AND DATE OF SHIPMENT	CONNECTING LINE REFERENCE	PREVIOUS WAYBILL REFERENCE	ORIGINAL CAR INITIAL AND NUMBER

WEIGHED AT TRR State Docks, Mobile, Ala. GROSS TARE NET

NUMBER OF PACKAGES, ARTICLES AND MARKS	WEIGHT	RATE	FREIGHT	ADVANCES	TOTAL
1986 bags Blue Asbestos Fibre	202700	.92	1864.84		1864.84
L&N 98726, 705 bags, Gross 127300, Tare 54900, Net 72400.					
NYC 71480, 705 bags, Gross 128100, Tare 56700, Net 71400.					
CGA 2638, 576 bags, Gross 119800, Tare 60900, Net 58900.					

DATE MATERIAL RECEIVED 12-8-67

CHARGE 53-2 9-5

APPROVED-STOREKEEPER [illegible]

The above shipment to your consignment has arrived at this station, and is ready for delivery. Unless unloaded or removed within free period allowed by published rules, same will be subject to demurrage or storage charges, as provided for in said rules. Unless this shipment is removed promptly it will be subject to sale as provided in the terms of the bill of lading.

Please deliver this consignment to bearer.

Consignee

Thank You-Your Business is Appreciated

MAKE CHECK PAYABLE TO SEABOARD AIR LINE RAILROAD COMPANY

DATE OF INVOICE	DESCRIPTION	AMOUNT	DISCOUNT	NET
12/29	1	22,300 00		22,300 00

001648

STATEMENT OF REMITTANCE

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA

ACCEPTANCE OF THIS CHECK WILL BE CONSIDERED FULL PAYMENT OF ITEMS LISTED ON THIS VOUCHER

APPROVED	MO.	DAY	YR.	TOTAL	VENDOR
m	02	02	68	22,300 00	NORTH AMER ASBESTOS CORP

DETACH AND RETAIN FOR YOUR FILE

JAN 8 1968

JAN 6 1968

NORTH AMERICAN ASBESTOS CORPORATION

200 SOUTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60604

TELEPHONE (312) 922-7435

INVOICE № 5684

DATE December 29, 1967

CUSTOMER ORDER NO. RM-44

OUR ORDER NO. 2023-2F

SOLD TO

Cement Asbestos Products Company,

Woodward, Alabama

EXEMPT FROM SALES OR

SHIPPED TO

Cement Asbestos Prod.
Ragland, Alabama

SHIPPED VIA ss"Reuben Tipton" to Port of Mobile SHIPPING DATE December 29, 1967

QUANTITY	DESCRIPTION	PRICE	TOTAL
100 Tons (2,000 bags)	Grade S Blue Fiber	@ $223.00 per ton f.o.b. vessel Port of Mobile 1/8 S.P.	$22,300.00
	Storage Charges for your account		
	Second and Final Shipment		
	TERMS: Net Ten Days		

REGISTER

INVOICE DATE 1229

DATE TO BE PAID 0202

LIST NO. 10102

OIL ACCT AB

INVOICE AMT 22,300.00

DISCOUNT

TYPE DISC.

CHARGE

LIST NO.

FINAL APPROVAL

REC'D BY

APPROVED

CSF 0055666

CAPCO KIN 0000417

MAKE CHECKS PAYABLE TO
ATLANTIC COAST LINE RAILROAD COMPANY

COPY—FREIGHT BILL

J&B-L-17802 Form No. 229

CONSIGNEE Ragland, Ala.

STATION Jan. 17, 1966 19

DESTINATION Cement Asbestos Products Co.

ROUTE

FREIGHT BILL NO. 30

(POINT OF ORIGIN TO DESTINATION) L&N Bham SCL.

To ATLANTIC COAST LINE RAILROAD CO., Dr., for Charges on Articles Transported:

WAYBILLED FROM	WAYBILL DATE AND NO.	FULL NAME OF SHIPPER	CAR INITIALS AND NO.
Mobile, Ala.	1/12/68 122349	Cement Asb. Prods.Co.	(see below)
ORIGIN & DATE OF SHIPMENT	CONNECTING LINE REFERENCE	PREVIOUS WAYBILL REFERENCES	ORIGINAL CAR, INITIALS AND NO.

NUMBER OF PACKAGES, ARTICLES AND MARKS	WEIGHT	RATE	FREIGHT	ADVANCES	TOTAL
600 Bags asbestos loaded in LV 62906, G-1072, T-456, N-	61600				
600 Bags loaded in C&O 16427 G-107500, T-45400, N-	62100				
600 Bags loaded in LP 192728, G-104700, T-42900, N-	61800				
	185500	92	1706.60		1706.60

DATE MATERIAL RECEIVED 1-18-68

CHARGE 53-2 9-5

APPROVED—STOREKEEPER DD

(This Form is not to be used as, or for a Receipted Freight Bill)

RECEIVED PAYMENT FOR THE RAILROAD COMPANY 19

Agent

COPY—NOT NEGOTIABLE

For copies use only this "COPY" Form. See Paragraph 871 Manual of Instructions.

CAPCO KIN 0000418

MAKE CHECKS PAYABLE TO
ATLANTIC COAST LINE RAILROAD COMPANY

COPY—FREIGHT BILL

J&B-L-17802 Form No. 229

CONSIGNEE Ragland, Ala.

STATION Jan. 17, 1968 19

DESTINATION Cement Asbestos Products Co.

FREIGHT BILL NO. 30

ROUTE

(POINT OF ORIGIN TO DESTINATION) L&N Bham SCL.

To ATLANTIC COAST LINE RAILROAD CO., Dr., for Charges on Articles Transported:

WAYBILLED FROM	WAYBILL DATE AND NO.	FULL NAME OF SHIPPER	CAR INITIALS AND NO.
..obile, Ala.	1/12/68 122349	Cement Asb. Prods.Co.	(SOU 68160)
ORIGIN & DATE OF SHIPMENT	CONNECTING LINE REFERENCE	PREVIOUS WAYBILL REFERENCES	ORIGINAL CAR, INITIALS AND NO.

NUMBER OF PACKAGES, ARTICLES AND MARKS	WEIGHT	RATE	FREIGHT	ADVANCES	TOTAL
600 Bags asbestos loaded in LV 62906, G-1072, T-456, N-	61600				
600 Bags loaded in C&O 16427 G-107500, T-45400, N-	62100				
600 Bags loaded in [illegible] 192720, G-104700, T-42900, N-	61800				
	185500	92	1706.60		1706.60

DATE MATERIAL RECEIVED 1-18-68

CHARGE 9-5

APPROVED—STOREKEEPER

(This Form is not to be used as, or for a Receipted Freight Bill)

VIA SCL

RECEIVED PAYMENT FOR THE RAILROAD COMPANY 19

Agent

COPY—NOT NEGOTIABLE

For copies use only this "COPY" Form. See Paragraph 871 Manual of Instructions.

CAPCO KIN 0000419

TYPE	MO	ACCT NOS →	1	2	3	DEPT	I/O	VESSEL NO	REQUESTED BY	SERVICE ORDER NO.
		INV NOS →				01	I		PHONE / LETTER / TELEGRAM / OPAL	R 21570 VP

ORDER DATE | INBOUND TO CAR 1 | TO TRK 2 | OUTBOUND EX CAR 3 | EX TRK 4 | BERTH Wh# 7 | FROM X | NTO | VESSEL Storage | DATE

① ACCOUNT OF Cement Asbestos Prod Co | FROM | TO | ③ CARRIER L & N

CONSIGNED TO | CAR NO UP 192728 | TRAILER NO

DLY ADDR | TRACK A6 | KIND OF CAR Box | CAPACITY 110000

DESTINATION Ragland, Ala. | LOAD LIMIT 134100 | LIGHT WT 42900

② AGENT BROKER FORWARDER | SEALS 153974/5 | GROSS WT

REFERENCE DATE | MONTH & CARRIER PRO NO | SEE ATTACHED | B/L WEIGHT | TARE WT

UNITS	KIND OF PACKAGE • COMMODITY DESCRIPTION • SERVICE	POUNDS	L	OFFICE USE ONLY
600	Bags Asbestos		1	S
			2	
			3	
	30 X 20 = 600		4	
			5	
			6	
			7	

EXCEPTIONS | BILL TO | LINE NO | TARIFF ITEM NO | AGENT | SHIPSIDE RATE

DATE STARTED 1/11/68 | DATE COMPLETED 1/11/68 | WAREHOUSE Wh# 7 | SECTION

NO OF SEPARATIONS | HANDLED BY A S D Yes | HEAVY LIFT | HEAVY LIFT ▶ UNITS LBS

DUNNAGE BRACED OR WIRED Dunnage | LABOR HRS | MATERIAL COST | BRACING

CHECKED BY [signature] | MARKING @ RATE

RECHECKED BY | LIFT TRK | TRACTOR | SCALE | CRANE | EQUIPMENT RENTAL HOURS

NON-NEGOTIABLE Received for shipment, transportation and delivery, subject to all terms and conditions of Carrier's current bill of lading, all contrary or conflicting terms or conditions herein contained being null and void | HANDLING TRANSFER

RECEIVED BY | SWITCHING

PER | TERMINAL USE @ RATE

PROTECT | WHARFAGE @ XX | HANDLING @ XX | BRACING @ 7.92 | OTHER Door Prot & Ch Bds. | STORAGE EXPORT PERIODS | STORAGE WAREHOUSE PERIODS

BILLING COPY

CAPCO KIN 0000420

MAKE CHECKS PAYABLE TO
ATLANTIC COAST LINE RAILROAD COMPANY

COPY—FREIGHT BILL

J&B-L-17802 Form No. 229

CONSIGNEE Cement Asbestos Products Co.

STATION Feb. 5, 1968 19

DESTINATION Ragland, Ala.

FREIGHT BILL NO. 56

ROUTE

(POINT OF ORIGIN TO DESTINATION) L&N Bham SCL

To ATLANTIC COAST LINE RAILROAD CO., Dr., for Charges on Articles Transported:

WAYBILLED FROM	WAYBILL DATE AND NO.	FULL NAME OF SHIPPER	CAR INITIALS AND NO.
Mobile, Ala.	1/12/68	Cement Asbestos Prods	Co. (see below)
ORIGIN & DATE OF SHIPMENT	CONNECTING LINE REFERENCE	PREVIOUS WAYBILL REFERENCES	ORIGINAL CAR, INITIALS AND NO.

NUMBER OF PACKAGES, ARTICLES AND MARKS	WEIGHT	RATE	FREIGHT	ADVANCES	TOTAL
READS: 600 bags Asb. in car LV 62906, 600 bags Asb in car C&O 16427 and 600 bags Asb. in car UP 192728	185500	.92	1706.60		1706.60
SHOULD READ: 600 bags Asb. in car LV 62906, 61600#, 600 bags Asb. in car C&O 16427, 62100# 600 bags Asb. in car UP 192728, 61800#, 198 bags Asb in car CEI 64668, 20400# Trailer Car.	205900	.92	1894.28		1894.28
UNDERCHARGE CORRECTION, ADDED, amt due	-20400	.92	187.68		187.68

(This Form is not to be used as, or for a Receipted Freight Bill)

RECEIVED PAYMENT FOR THE RAILROAD COMPANY

DATE MATERIAL RECEIVED
CHARGE
APPROVED—STOREKEEPER

19

Agent

COPY—NOT NEGOTIABLE

copies use only this "COPY" Form. See Paragraph 871 Manual of Instructions.

CAPCO KIN 0000421

C01985

STATEMENT OF REMITTANCE

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA

ACCEPTANCE OF THIS CHECK WILL BE CONSIDERED FULL PAYMENT OF ITEMS LISTED ON THIS VOUCHER.

DATE OF INVOICE	DIV.	AMOUNT	DISCOUNT	NET
2/20	1	22,50000		22,50000

APPROVED

MO 03 DAY 18 YR 88

TOTAL 22,50000

VENDOR NORTH AMER ASBESTOS CORP

DETACH AND RETAIN FOR YOUR FILE

CAPCO KIN 0000422

FEB 2[illegible]

FEB 26 1968

NORTH AMERICAN ASBESTOS CORPORATION

200 SOUTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60604

TELEPHONE (312) 922-7435

INVOICE No. 5754

DATE February 20, 1968

SOLD TO

Cement Asbestos Products Company
Woodward, Alabama

CUSTOMER ORDER NO. RM-49
Release No. 1
OUR ORDER NO. 2104-1

SHIPPED TO
Cement Asbestos Products Co.
c/o W. H. Beasley, S.K.
Ragland, Alabama

SHIPPED VIA "Nederburg" to port of Mobile
Rail to your plant

SHIPPING DATE February 15, 1968

QUANTITY	DESCRIPTION	PRICE	TOTAL
100 tons (2000 bags)	Grade OWS Blue Fiber	2/26 S.P. @ $225.00 per ton f.o.b. Port of Mobile	$ 22,500.00
	First Partial Shipment		
	TERMS: Net Ten Days		

DATE APPROVED
PRICE & TERMS APPROVED
CHGD.
MATERIAL REC'D
CHARGE
LIST NO.
APPROVAL

CAPCO KIN 0000423

MAKE CHECKS PAYABLE TO
ATLANTIC COAST LINE RAILROAD COMPANY

COPY—FREIGHT BILL

J&B-L-17802 Form No. 229

CONSIGNEE Cement Asbestos Products Co. STATION March 23, 1968 19

DESTINATION Ragland, Ala.

ROUTE L&N Bham SCL FREIGHT BILL NO. 164

(POINT OF ORIGIN TO DESTINATION)

To ATLANTIC COAST LINE RAILROAD CO., Dr., for Charges on Articles Transported:

WAYBILLED FROM	WAYBILL DATE AND NO.	NAME OF SHIPPER	CAR INITIALS AND NO.
Mobile, Ala.	3/7/68 126286	N.Amer Asb Corp	(see below)
ORIGIN & DATE OF SHIPMENT	CONNECTING LINE REFERENCE	PREVIOUS WAYBILL REFERENCES	ORIGINAL CAR, INITIALS AND NO.

NUMBER OF PACKAGES, ARTICLES AND MARKS	WEIGHT	RATE	FREIGHT	ADVANCES	TOTAL
2000 bags blue asbestos, crude, SLC	203400	92	1871.28		
RI 22697, 555 bags 101200 44400 56800.	WFGE	28NT		28.48	
RI 21834 500 bags 97500 45400 52100.	Mdlg	1.61NT		163.74	
SAL 21170 760 bags 133800 57900 75900.				192.22	
TP 41236 185 bags 67700 49100 18600.					2063.50

DATE MATERIAL RECEIVED 3-22-68

CHARGE 53.2 9-5

APPROVED—STOREKEEPER [illegible]

(This Form is not to be used as, or for a Receipted Freight Bill)

RECEIVED PAYMENT FOR THE RAILROAD COMPANY 19

Agent

COPY—NOT NEGOTIABLE

For copies use only this "COPY" Form. See Paragraph 871 Manual of Instructions.

CAPCO KIN 0000424

002131

STATEMENT OF REMITTANCE

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA

ACCEPTANCE OF THIS CHECK WILL BE CONSIDERED FULL PAYMENT OF ITEMS LISTED ON THIS VOUCHER.

DATE OF INVOICE	DIV.	AMOUNT	DISCOUNT	NET
3/26	1	22,500 00		22,500 00

APPROVED

MO. 04 DAY 10 YR 68

TOTAL 22,500 00

VENDOR NORTH AMER ASBESTOS CORP

DETACH AND RETAIN FOR YOUR FILE

APR 2 1968

MAR 30 1968

NORTH AMERICAN ASBESTOS CORPORATION

200 SOUTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60604

TELEPHONE (312) 922-7435

INVOICE No. 5803

DATE March 29, 1968

SOLD TO

Cement Asbestos Products Company

Ragland, Alabama

CUSTOMER ORDER NO. RM-49
Rel. No. 2
OUR ORDER NO. 2104-2

SHIPPED TO
Cement Asbestos Company
c/o W. H. Beasley, S. K.
Ragland, Alabama

SHIPPED VIA "S. A. Vanguard" to Port of Mobile
L & N Rail to your plant

SHIPPING DATE March 20, 1968

QUANTITY	DESCRIPTION	PRICE	TOTAL
100 tons (2000 bags)	Grade OWS Blue Fiber	@ $225.00 per ton f. o. b. Port of Mobile	$ 22,500.00
	Second Partial Shipment		
	TERMS: Net Ten Days		

EXEMPT FROM ALABAMA SALES OR USE TAX

CAPCO KIN 0000426

To **SEABOARD COAST LINE RAILROAD CO., DR.**
FOR CHARGES ON ARTICLES TRANSPORTED

COPY FREIGHT BILL

FORM 723
REV 10/67

BILL. RD.	ORG. AUDIT	WAYBILL DATE AND NUMBER	SHIPPER'S NUMBER	FREIGHT BILL DATE AND NUMBER	PAGE
444	08440	03/21/68 127380		05/08/68 444-08440-127380	1

DESTINATION	ORIGIN
RAGLAND AL	MOBILE AL

ROUTE
LN

CONSIGNEE	SHIPPER
CEMENT ASBESTOS PRODUCTS CO.	NORAMEASB

CUSTOMER NAME AND ADDRESS
CEMENT ASBESTOS PRODUCTS CO.
P.O. BOX 119
RAGLAND, ALA. 35131

COMMODITY
ASBESTOS, CRUDE

Thanks For Using Coast Line

INITIAL AND NUMBER			WEIGHT	RATE	FREIGHT	ADVANCES	PREPAID
CNL 080200			202300	.9200	1,861.16		
G 108000 T	51500 A	NET	56500				
LN 108113	WHARFAGE HANDLING		-	-		191.17	
G 121600 T	54800 A	NET	66800				
NW 361016			-	-			
G 104900 T	49300 A	NET	55600				
SCL 047690			-	-			
G 71200 T	47800 A	NET	23400				

DATE MATERIAL RECEIVED 3-28-68
CHARGE 53-2 9-2
APPROVED—STOREKEEPER

PLEASE REMIT IN ENCLOSED SELF-ADDRESS ENVELOPE
4779 PAYABLE ON OR BEFORE 5/15/68

AMOUNT DUE
2,052.3[illegible]

CAPCO KIN 0000427

004852

STATEMENT OF REMITTANCE

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA

ACCEPTANCE OF THIS CHECK WILL BE CONSIDERED FULL PAYMENT OF ITEMS LISTED ON THIS VOUCHER.

DATE OF INVOICE	AMOUNT	DISCOUNT	NET
4-30			22,500.00

APPROVED LTS

MO 5 DAY 10 YR 68

TOTAL 22,500.00

VENDOR North American Asbestos Corp.

DETACH AND RETAIN FOR YOUR FILE

MAY 6 1968

NORTH AMERICAN ASBESTOS CORPORATION

200 SOUTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60604

TELEPHONE (312) 922-7435

MAY 3 1968

INVOICE No. 5852

DATE April 30, 1968

CUSTOMER ORDER NO. RM-58
Rel. No. 1
OUR ORDER NO. 2152-1

SOLD TO

Cement Asbestos Products Company
Woodward, Alabama 35189

SHIPPED TO
Cement Asbestos Company
c/o R. G. Jackson
Ragland, Alabama

SHIPPED VIA "S. A. Nederburg" to Port of Mobile L & N Rail to your plant

SHIPPING DATE April 29, 1968

QUANTITY	DESCRIPTION	PRICE	TOTAL
100 tons (2,000 bags)	Grade OWS Blue Fiber	@ $225.00 per ton f.o.b. Port of Mobile	$22,500.00
	First Partial Shipment		7165
	TERMS: Net Ten Days	EXEMPT SALES OR USE	

CAPCO KIN 0000429

Form 3570

(For use in connection with Uniform Domestic Straight Bill of Lading, adopted by Carriers in Official, Southern, Western and Illinois Classification Territories, March 15, 1922, as amended August 1, 1930, and June 15, 1941.)

3rd SHEET

L&N **THIS MEMORANDUM** is an acknowledgment that a Bill of Lading has been issued and is not the Original Bill of Lading, nor a copy or duplicate, covering the property named herein, and is intended solely for filing or record.

Shipper's No.

Agent's No.

RECEIVED, subject to the classifications and tariffs in efftct on the date of the receipt by the carrier of the property described in the Original Bill of Lading.

at PIER A.S.D. MOBILE, ALA. MAY 10TH, 1968 ~~XXXXX~~, 19 68

from NORTH AMERICAN ASBESTOS CORP. CHICAGO ILL.

the property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below, which said company (the word company being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its own road or its own water line, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the conditions not prohibited by law, whether printed or written, herein contained, including the conditions on back hereof, which are hereby agreed to by the shipper and accepted for himself and his assigns.

Mail or street address of consignee—For purposes of notification only.

Consigned to CEMENT ASBESTOS PRODUCTS (COR. ORDER NO. RM-58 RELASE 2)

Destination RAGLAND ALA. State of County of

Route L & N BHAM SCL (FOUR CARS - SEE BELOW)

Delivering Carrier ~~XXXXXXXX~~ SCL DELY Car Initial Car No.

No. Packages	DESCRIPTION OF ARTICLES, SPECIAL MARKS, AND EXCEPTIONS	*WEIGHT (Subject to Correction)	CLASS OR RATE	CHECK COLUMN
~~2000~~	~~BAGS CRUDE ASBESTOS~~	~~1202,000~~ 203,600#		
	~~EX: S A NEDERBURG B/L 1 DURBAN~~			
	PIER			
	MKD: "S"			
L&N	106593 - 600 BAGS - GROSS 117800 TARE 56400 NET 61400			
	SEALS: 159620-21			
CBQ	17278 - 500 BAGS - GROSS 94500 TARE 44000 NET 50500			
	SEALS: 159622-23			
SLSF	40154 - 500 BAGS - GROSS 111600 TARE 60000 NET 51600			
	SEALS: 155839-40			
N ~~L&N~~	108787 - 400 BAGS - GROSS 94800 TARE 54700 NET 40100			
	SEALS: 155841-42			

Subject to Section 7 of conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:

The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

(Signature of Consignor.)

If charges are to be prepaid, write or stamp here, "To be Prepaid."

COLLECT

Received $ to apply in prepayment of the charges on the property described hereon.

Agent or Cashier.

Per

(The signature here acknowledges only the amount prepaid.)

*If the shipment moves between two ports by a carrier by water, the law requires that the bill of lading shall state whether it is "carrier's or shipper's weight."

NOTE—Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.

The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

Charges Advanced:

TERMINAL RAILWAY, ALA. STATE DOCKS, MOBILE, ALA. Gross Tare (Actual) Pers (Marked) Net Capacity ... AUTHORITY ... and I.S.

RECEIVED MAY 10 1968 L&N YARD OFFICE MOBILE ALA.

I.D. CUNNINGHAM AND CO. Shipper Hugh Justice, Agent

Per

ent postoffice address of Shipper

3

CAPCO KIN 0000430

To **SEABOARD COAST LINE RAILROAD CO., DR.**
FOR CHARGES ON ARTICLES TRANSPORTED

COPY FREIGHT BILL

FORM 223
REV 10/67

BILL RD	ORG AUDIT	WAYBILL DATE AND NUMBER	SHIPPER'S NUMBER	FREIGHT BILL DATE AND NUMBER		PAGE
444	08440	05/10/68 130978		06/03/68	444-08440-130978	1

DESTINATION: RAGLAND AL

ORIGIN: MOBILE AL

ROUTE: LN BHAM SCL

CONSIGNEE: CEMENT ASBESTOS PRODUCTS CO.

SHIPPER: NORAMEASB

CUSTOMER NAME AND ADDRESS:
CEMENT ASBESTOS PRODUCTS CO.
P.O. BOX 119
RAGLAND, ALA. 35131

COMMODITY: ASBESTOS, CRUDE

INITIAL AND NUMBER	WEIGHT	RATE	FREIGHT	ADVANCES	PREPAID
CBL 017278 WHARFAGE HANDLING	-	-		28.50	
LN 106593	203600	.9200	1,873.12		
LN 108787	-	-			
SLSF 040154 WHARFAGE HANDLING	-	-		163.90	

DATE MATERIAL RECEIVED 5-27-65
CHART - 53-2 (9-5)
APPROVED—STOREKEEPER [illegible]

PLEASE REMIT IN ENCLOSED SELF-ADDRESS ENVELOPE
2 E 4927 PAYABLE ON OR BEFORE 6/10/68

AMOUNT DUE: 2,065.52

CAPCO KIN 0000431

004871

STATEMENT OF REMITTANCE

CEMENT ASBESTOS PRODUCTS COMPANY

WOODWARD, ALABAMA

ACCEPTANCE OF THIS CHECK WILL BE CONSIDERED FULL PAYMENT OF ITEMS LISTED ON THIS VOUCHER.

DATE INVOICE	DIV.	AMOUNT	DISCOUNT	NET
5-16				22,500.00
5-16				22,500.00

APPROVED

MO 5 DAY 27 YR 68

TOTAL 45,000.00

VENDOR North American Asbestos Corp.

DETACH AND RETAIN FOR YOUR FILE

MAY 20 1968

NORTH AMERICAN ASBESTOS CORPORATION

200 SOUTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60604

TELEPHONE (312) 922-7435

INVOICE № 5881

DATE May 16, 1968

CUSTOMER ORDER NO. RM-58

OUR ORDER NO. 2152-2

SOLD TO

Cement Asbestos Products Company

Woodward, Alabama 35189

SHIPPED TO

Cement Asbestos Company
c/o A.S.D. Storage
Mobile, Alabama

SHIPPED VIA "Stella Lykes" to Port of Mobile Inland Frt. to A.S.D. Storage

SHIPPING DATE May 10, 1968

QUANTITY	DESCRIPTION	PRICE	TOTAL
100 tons (2,000 bags)	Grade OWS Blue Fiber	@ $225.00 per ton f.o.b. Port of Mobile	$22,500.00
	Second Partial Shipment		
	TERMS: Net Ten Days		

REGISTER 7742
INVOICE DATE
DATE TO FL PAID
LIST NO
G.L. ACCT.
INVOICE AMT
DISCOUNT
TYPE DISC

APPROVED
M.O.
CHGE

EXEMPT FROM ALABAMA SALES OR USE TAX

May 6
CHARGE 9.5
LIST NO. 2
FINAL APPROVAL

9-12
APPROVED

CAPCO KIN 0000433

MAY 20 1968

NORTH AMERICAN ASBESTOS CORPORATION

200 SOUTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60604

TELEPHONE (312) 922-7435

INVOICE **Nº** 5870

DATE May 16, 1968

SOLD TO

Cement Asbestos Products Company

Woodward, Alabama 35189

CUSTOMER ORDER NO. RM-49
Rel. No. 3F

OUR ORDER NO. 2104-3F

SHIPPED TO
Cement Asbestos Company
c/o W. H. Beasley, S. K.
Ragland, Alabama

SHIPPED VIA "Stella Lykes" to Port of Mobile
L & N Rail to your plant

SHIPPING DATE May 10, 1968

QUANTITY	DESCRIPTION	PRICE	TOTAL
100 tons (2,000 bags)	Grade OWS Blue Fiber	@ $225.00 per ton f. o. b. Port of Mobile	$22,500.00
	Third and Final Shipment		
	TERMS: Net Ten Days		

REGISTER 7210
INVOICE DATE
DATE TO BE PAID
LIST NO.
G/L ACCT.
INVOICE AMT.
DISCOUNT
TAX DISC.

CHARGE 5-5
LIST NO. 2
FINAL APPROVAL

EXEMPT FROM ALABAMA SALES OR USE TAX

CAPCO KIN 0000434

20M Sets - 4-65

Form 3570

(For use in connection with Uniform Domestic Straight Bill of Lading, adopted by Carriers in Official, Southern, Western and Illinois Classification Territories, March 15, 1922, as amended August 1, 1930, and June 15, 1941.)

3rd SHEET

L&N

THIS MEMORANDUM is an acknowledgment that a Bill of Lading has been issued and is not the Original Bill of Lading, nor a copy or duplicate, covering the property named herein, and is intended solely for filing or record.

Shipper's No.

Agent's No.

RECEIVED, subject to the classifications and tariffs in efftct on the date of the receipt by the carrier of the property described in the Original Bill of Lading.

at OUTH C, A.S.D. MOBILE, ALA. MAY ~~xxx~~ 15TH, 19 68

from NORTH AMERICAN ASBESTOS CORP. 200 SO. MICHIGAN AVE CHICAGO ILL

the property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below, which said company (the word company being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its own road or its own water line, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the conditions not prohibited by law, whether printed or written, herein contained, including the conditions on back hereof, which are hereby agreed to by the shipper and accepted for himself and his assigns.

(Mail or street address of consignee—For purposes of notification only.)

Consigned to CEMENT ASBESTOS PRODUCTS COMPANY ORDER 2152-1
RAGLAND ALA.

Destination State of County of

Route L & N BHAM SCL

(FOUR CARS - SEE BELOW)

Delivering Carrier Car Initial Car No.

No. Packages	DESCRIPTION OF ARTICLES, SPECIAL MARKS, AND EXCEPTIONS	*WEIGHT (Subject to Correction)	CLASS OR RATE	CHECK COLUMN
2000	BAGS BLUE CRUDE ASBESTOS	~~[illegible]~~		
		206,300		
	EX: STELLA LYKES B/L 1, DURBAN			
	PIER SOUTH C			
	MKD: 'S			
RI	23313 - 500 BAGS - GROSS 97100 TARE 45800 NET 51300			
	SEALS: 159626-27			
MP	129838 - 500 BAGS - GROSS 99100 TARE 47400 NET 51700			
	SEALS: 159628-29			
KCS	2665 - 500 BAGS - GROSS 117100 TARE 63700 NET 53400			
	SEALS: 157807-08			
CGW	93305 - 500 BAGS - gross 96000 TARE 46100 NET 49900			
	SEALS: 159624-25			

Subject to Section 7 of conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:

The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

(Signature of Consignor.)

If charges are to be prepaid, write or stamp here, "To be Prepaid."

COLLECT

Received $ to apply in prepayment of the charges on the property described hereon.

Agent or Cashier.

Per

(The signature here acknowledges only the amount prepaid.)

Charges Advanced:

*If the shipment moves between two ports by a carrier by water, the law requires that the bill of lading shall state whether it is "carrier's or shipper's weight."

NOTE—Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.

The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

Per (Actual)

Tare (Marked)

Net Shipper. Length

Per S. W. Per

N.D. CUNNINGHAM AND CO. Hugh Justice, VICSA Agent

Per

Permanent postoffice address of Shipper P.O. MOBILE, ALA.

RECEIVED MAY 15 1968 L&N YARD OFFICE MOBILE ALA.

3

CAPCO KIN 0000435

To **SEABOARD COAST LINE RAILROAD CO., DR.**
FOR CHARGES ON ARTICLES TRANSPORTED

COPY FREIGHT BILL

FORM 223
REV 10/67

BILL RD	ORG. AUDIT	WAYBILL DATE AND NUMBER	SHIPPER'S NUMBER	FREIGHT BILL DATE AND NUMBER	PAGE
444	08440	05/15/68 131346	:	06/07/68 444-08440-131346	1

DESTINATION	ORIGIN
RAGLAND AL	MOBILE AL

ROUTE
LN BHAM SCL

CONSIGNEE	SHIPPER
CEMENT ASBESTOS PRODUCTS CO.	MAEASBEST

CUSTOMER NAME AND ADDRESS	COMMODITY
CEMENT ASBESTOS PRODUCTS CO. P.O. BOX 119 RAGLAND, ALA. 35131	ASBESTOS, CRUDE [illegible] For Using Cross Line

INITIAL AND NUMBER	WEIGHT	RATE	FREIGHT	ADVANCES	PREPAID
CCW 093305	-	-			
KCS 002365 WHARFAGE HANDLING	-	-		166.07	
MP 129338 WHARFAGE HANDLING	-	-		26.38	
RI 023313	206300	.9200	1,697.96		

DATE MATERIAL RECEIVED 5-15-68
CHARGE 53-2 (9-5)
APPROVED-STOREKEEPER [illegible]
Copy

PLEASE REMIT IN ENCLOSED SELF-ADDRESS ENVELOPE
2 F 0067 PAYABLE ON OR BEFORE 6/14/68

AMOUNT DUE ~~2,092.91~~

CAPCO KIN 0000436

004891

STATEMENT OF REMITTANCE

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA

ACCEPTANCE OF THIS CHECK WILL BE CONSIDERED FULL PAYMENT OF ITEMS LISTED ON THIS VOUCHER.

DATE OF INVOICE	VOUCHER NO.	AMOUNT	DISCOUNT	NET
6-14				22,500.00

Coal Drabursement

Previously Entered

REGISTER
INVOICE DATE 0614
DATE TO BE PAID 0701
LIST NO. 1
G/L ACCT. AB
INVOICE AMT. 22,500.00
DISCOUNT
TYPE DISC.

APPROVED

MO	DAY	YR	TOTAL	VENDOR
7	1	68	22,500.00	North American Asbestos Corp.

DETACH AND RETAIN FOR YOUR FILE

JUN 1968

JUN 17 1968

NORTH AMERICAN ASBESTOS CORPORATION

200 SOUTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60604

TELEPHONE (312) 922-7435

INVOICE Nº 5926

DATE June 14, 1968

CUSTOMER ORDER NO. RM-58

Rel. No. 3

OUR ORDER NO. 2152-3

SOLD TO

Cement Asbestos Products Company

Woodward, Alabama 35189

SHIPPED TO

Cement Asbestos Company
c/o R. G. Jackson
Ragland, Alabama

SHIPPED VIA S. S. "Tyson Lykes" to Port of Mobile
L & N Rail to your Plant

SHIPPING DATE June 11, 1968

QUANTITY	DESCRIPTION	PRICE	TOTAL
100 tons (2,000 bags)	Grade OWS Blue Fiber paper lined hessian bags	@ $225.00 per ton f.o.b. Port of Mobile	$22,500.00
	Third Partial Shipment		
	TERMS: Net Ten Days		

DATE APPROVED 6/17 Mobile

PRICE & TERMS

CALCULATIONS

CHECKED

TRANSPORTATION

MATERIAL REC'D

6-19-68 DATE

C. Clark REC'D BY

CHARGE 9-5

LIST NO. 2 APPROVED

FINAL APPROVAL

EXEMPT FROM ALABAMA SALES OR USE TAX

0614

0701

22500.00

CAPCO KIN 0000438

To SEABOARD COAST LINE RAILROAD CO., DR.
FOR CHARGES ON ARTICLES TRANSPORTED

FORM 223
REV 10/67

BILL. RD.	ORG. AUDIT	WAYBILL DATE AND NUMBER	SHIPPER'S NUMBER	FREIGHT BILL DATE AND NUMBER	PAGE
444	08440	06/13/68 123452		12/06/68 444-08440-123452	1

DESTINATION: RAGLAND AL

ORIGIN: MOBILE AL

ROUTE: LN BHAM SCL

CONSIGNEE: CEMENT ASBESTOS PRODUCTS CO.

SHIPPER: NOTAMEASB

CUSTOMER NAME AND ADDRESS:
CEMENT ASBESTOS PRODUCTS CO.
P.O. BOX 119
RAGLAND, ALA. 35131

COMMODITY:
ASBESTOS, CRUDE

For Using Coast Line

INITIAL AND NUMBER		WEIGHT	RATE	FREIGHT	ADVANCES	PREPAID
BC 385515		-	-			
G S8800 T 48500 A	N	50300				
CEI 165582 WHARFAGE HANDLING		-	-		27.85	
G S4200 T 44900 A	N	49300				
CNW C24595		320000	.5000	1,600.00		
G S7400 T 47200 A	N	50200				
SCU 046532 WHARFAGE HANDLING		-	-		160.11	
G S9200 T 50100 A	N	49100				

DATE MATERIAL RECEIVED 6-19-68

CHARGE 532 (9-5)

APPROVED—STOREKEEPER

Copy

2 K 5345

PLEASE REMIT IN ENCLOSED SELF-ADDRESS ENVELOPE
PAYABLE ON OR BEFORE 12/13/68

AMOUNT DUE 1,787.96

CAPCO KIN 0000439

002975

STATEMENT OF REMITTANCE

CEMENT ASBESTOS PRODUCTS COMPANY

WOODWARD, ALABAMA

ACCEPTANCE OF THIS CHECK WILL BE CONSIDERED FULL PAYMENT OF ITEMS LISTED ON THIS VOUCHER.

DATE OF INVOICE	DIV.	AMOUNT	DISCOUNT	NET
6/28	1	22,500 00		22,500 00

APPROVED

MO 08 DAY 09 YR 68

TOTAL 22,500 00

VENDOR NORTH AMER ASBESTOS CORP

DETACH AND RETAIN FOR YOUR FILE

NORTH AMERICAN ASBESTOS CORPORATION

200 SOUTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60604

TELEPHONE (312) 922-7435

JUL 1 1968

INVOICE No. 5955

DATE June 28, 1968

SOLD TO

Cement Asbestos Products Company

Woodward, Alabama 35189

CUSTOMER ORDER NO. RM-58
Rel. No. 4

OUR ORDER NO., 2152-4

SHIPPED TO

Cement Asbestos Company
c/o R. G. Jackson
Ragland, Alabama

SHIPPED VIA s. s. "Charles Lykes" to Port of Mobile
L & N Rail to your plant

SHIPPING DATE June 27, 1968

QUANTITY	DESCRIPTION	PRICE	TOTAL
100 tons (2,000 bags)	Grade OWS Blue Fiber paper lined hessian bags	@ $225.00 per ton f. o. b. Port of Mobile	$22,500.00
	Fourth Partial Shipment		
	TERMS: Net Ten Days		

REGISTER
INVOICE DATE 06-28
DATE TO BE PAID 08 05
TST NO.
GL ACCT
INVOICE AMT 22,500.00
DISCOUNT
TAX DISC.

LIST NO. 2
FINAL APPROVAL

EXEMPT FROM ALABAMA SALES OR USE TAX

CAPCO KIN 0000441

30M Sets - 4-65 Form 35/0

(Uniform Domestic Straight Bill of Lading, adopted by Carriers in Official, Southern, Western and Illinois Classification Territories, March 15, 1922, as amended August 1, 1930 and June 15, 1941.) 1st SHEET

UNIFORM STRAIGHT BILL OF LADING

ORIGINAL—NOT NEGOTIABLE

Shipper's No.

Agent's No.

Louisville & Nashville Railroad Company

RECEIVED, subject to the classifications and tariffs in effect on the date of the issue of this Bill of Lading,

at PIER: NORTH C , A.S.D., MOBILE, ALABAMA JUNE 27, 19 68

from NORTH AMERICAN ASBESTOS CORP., 200 SO. MICHIGAN AVE., CHICAGO, ILL.

the property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below, which said company (the word company being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its own road or its own water line, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the conditions not prohibited by law, whether printed or written, herein contained, including the conditions on back hereof, which are hereby agreed to by the shipper and accepted for himself and his assigns.

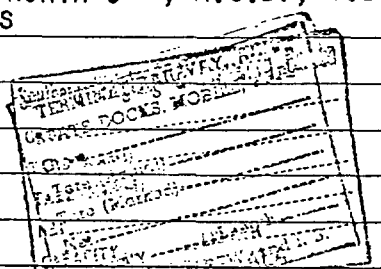
Consigned to CEMENT ASBESTOS PRODUCTS CO. (Mail or street address of consignee—For purposes of notification only.) ORDERS RM-58 RELEASE NO. 4

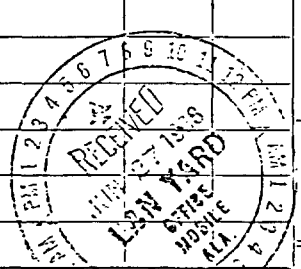
Destination RAGLAND, ALA. State of County of

Route L&N RAILROAD CO. BHAM SCL

Delivering Carrier Car Initial SEE RIDER ATTCHED Car No.

No. Packages	DESCRIPTION OF ARTICLES, SPECIAL MARKS, AND EXCEPTIONS	*WEIGHT (Subject to Correction)	CLASS OR RATE	CHECK COLUMN
2,000	BAGS BLUE CRUDE ASBESTOS	202,000		
	GROSS TARE	NET		
MP 123956	500 BAGS 100900 49400	51500		
NP 18733	500 DO 96700 45800	50900		
GN 93900	500 DO 93900 42800	51100		
CNW 8617	500 DO 97900 46900	51000		
	*			
	2000 BAGS 389400 184900	204500		
	EX: CHARLES LYKES, B/L 4, DURBAN			
	PIER: NORTH C , A.S.D., MOBILE, ALA.			
	MKD: S			





Subject to Section 7 of conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:

The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

(Signature of Consignor.)

If charges are to be prepaid, write or stamp here, "To be Prepaid."

COLLECT

Received $ to apply in prepayment of the charges on the property described hereon.

Agent or Cashier.

Per

(The signature here acknowledges only the amount prepaid.)

Charges Advanced:

$

*If the shipment moves between two ports by a carrier by water, the law requires that the bill of lading shall state whether it is carrier's or shipper's weight."

NOTE—Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.

The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

per

N.D. CUNNINGHAM AND CO., INC. Shipper. HUGH JUSTICE MCSA Agent

Per Per HEM

Permanent postoffice address of Shipper P.O. BOX 15, MOBILE, ALA. 1

CAPCO KIN 0000442

003067

STATEMENT OF REMITTANCE

CEMENT ASBESTOS PRODUCTS COMPANY

WOODWARD, ALABAMA

ACCEPTANCE OF THIS CHECK WILL BE CONSIDERED FULL PAYMENT OF ITEMS LISTED ON THIS VOUCHER.

DATE OF INVOICE	DIV.	AMOUNT	DISCOUNT	NET
6/08	1	18,675 00		18,675 00

APPROVED

MO 06 DAY 20 YR 68

TOTAL 18,675 00

VENDOR NORTH AMER ASBESTOS CORP

DETACH AND RETAIN FOR YOUR FILE

CAPCO KIN 0000443

AUG 13 1968

AUG 11 1968

NORTH AMERICAN ASBESTOS CORPORATION

200 SOUTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60604

TELEPHONE (312) 922-7435

INVOICE № 5989

DATE August 8, 1968

CUSTOMER ORDER NO. RM 58
Rel. No. 5

OUR ORDER NO. 2152-5

SOLD TO

Cement Asbestos Products Company

Woodward, Alabama 35189

SHIPPED TO
Cement Asbestos Company
c/o R. G. Jackson
Ragland, Alabama

SHIPPED VIA "Velma Lykes" to Port of Mobile
L & N Rail to your plant

SHIPPING DATE August 2, 1968

QUANTITY	DESCRIPTION	PRICE	TOTAL
83 tons (1,660 bags)	Grade OWS Blue Fiber paper lined hessian bags	@ $225.00 per ton f.o.b. Port of Mobile	$18,675.00
	Fifth Partial Shipment		
	TERMS: Net Ten Days		

REGISTER 8719
INVOICE DATE
DATE TO BE PAID
LIST NO.
G.L. ACCT.
INVOICE AMT.
DISCOUNT
TYPE DISC.

GIVE SPECIAL ATTENTION AND REQUEST FOR DISCOUNT
8-12

DATE APPROVED 8/13
PRICE & TERMS APPROV.
CALCULATIONS
CHECKED
TRANSPORTATION
1943 27
MATERIAL REC'D
DATE
REC'D BY
CHARGE 9-5
LIST NO 2
APPROVED
FINAL APPROVAL

EXEMPT FROM ALABAMA SALES OR USE TAX

CAPCO KIN 0000444

To **SEABOARD COAST LINE RAILROAD CO., DR.**
FOR CHARGES ON ARTICLES TRANSPORTED

COPY FREIGHT BILL

FORM 223
REV. 10/67

BILL. RD.	ORG. AUDIT	WAYBILL DATE AND NUMBER	SHIPPER'S NUMBER	FREIGHT BILL DATE AND NUMBER	PAGE
444	08440	08/03/68 127033		08/21/68 444-08440-127033	1

DESTINATION	ORIGIN
RAGLAND AL	MOBILE AL

ROUTE
LN BHAM SCL

CONSIGNEE	SHIPPER
CEMENT ASBESTOS PRODUCTS CO.	NCRAMEASB

CUSTOMER NAME AND ADDRESS
CEMENT ASBESTOS PRODUCTS CO.
P.O. BOX 119
RAGLAND, ALA. 35131

COMMODITY
ASBESTOS, CRUDE

Seaboard Coast Line

INITIAL AND NUMBER	WEIGHT	RATE	FREIGHT	ADVANCES	PREPAID
LN 005152 SPLIT DELY CHG	-	-		134.35	
LN 091545 SPLIT DELY CHG	-	-		23.37	
LN 091918	166900	.9500	1,585.55		
LN 108584	-	-			

DATE MATERIAL RECEIVED 8-9-68
CHARGE 533 9-5
APPROVED—STOREKEEPER M.D.

PLEASE REMIT IN ENCLOSED SELF-ADDRESS ENVELOPE
PAYABLE ON OR BEFORE 8/28/68

AMOUNT DUE
1,743.27

2 H 1989

CAPCO KIN 0000445

N. D. CUNNINGHAM & CO., INC.
FORWARDERS & CUSTOMS BROKERS
MOBILE, ALA.

PRO FORMA CLAIM
OVER, SHORT OR DAMAGED
CARGO REPORT

AUGUST 9, 1963

S/S VELMA LYKES

LYKES BROS. STEAMSHIP CO. INC.
6TH FLOOR NATIONAL BANK BUILDING
MOBILE, ALA.

YOU ARE HEREBY NOTIFIED OF THE DISCREPANCY IN SHIPMENT AS INDICATED BELOW:

SHIPPER NAMED ON B/L T

ORIGIN REP OF SO AFRICA EXIT PORT DURBAN

DEL. CARRIER VELMA LYKES ULT. DEST. MOBILE

FOR ACCOUNT OF NORTH AMERICAN ASBESTOS CORP. ATTN. 200 SO MICHIGAN AVE CHICAGO ILL

CAR NUMBER LEN 91915, 91545, 5152, 103584,

COMMODITY 1660 BAGS CRUDE ASBESTOS

MARKED "S"

CLAIM 7 BAGS SHORT

REMARKS SHORTAGE NOTED AT TIME OF PICKUP BY INLAND CARRIERS

I CERTIFY that this Report is Correct. In my opinion the OCEAN CARRIER is liable.

Meanwhile on behalf of our Principals we hold you Fully Liable and Reserve Right to File Claim at a Future Date.

N. D. CUNNINGHAM & CO., INC.

BY:
MABEL GREER

CAPCO KIN 0000446

Form 3570

(Uniform Domestic Straight Bill of Lading, adopted by Carriers in Official, Southern, Western and Illinois Classification Territories, March 15, 1922, as amended August 1, 1930 and June 15, 1941.)

1st SHEET

UNIFORM STRAIGHT BILL OF LADING

ORIGINAL—NOT NEGOTIABLE

Shipper's No.

Agent's No.

Louisville & Nashville Railroad Company

RECEIVED, subject to the classifications and tariffs in effect on the date of the issue of this Bill of Lading,

at PIER NORTH C, A.S.D. MOBILE, ALA. AUGUST 3RD, 1968 ~~XXXXXXXX~~ 19 68

from NORTH AMERICAN ASBESTOSCORP. CHICAGO ILL

the property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below, which said company (the word company being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its own road or its own water line, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the conditions not prohibited by law, whether printed or written, herein contained, including the conditions on back hereof, which are hereby agreed to by the shipper and accepted for himself and his assigns.

Consigned to CEMENT ASBESTOS PRODUCTS CO. (Mail or street address of consignee—For purposes of notification only.) ~~XXXXXXX~~ ORDER NO. RM-58

Destination RAGLAND ALA. State of County of

Route ~~XXL~~& N BHAM SCL ~~(FOUR CARS - SEE BELOW)~~

Delivering Carrier SCL Car Initial Car No.

No. Packages	DESCRIPTION OF ARTICLES, SPECIAL MARKS, AND EXCEPTIONS	*WEIGHT (Subject to Correction)	CLASS OR RATE	CHECK COLUMN
~~1770~~	BAGS CRUDE ASBESTOS	~~1771770~~		
1653		166900		
	EX: VELMA LYKES B/L 1 DURBAN			
	PIER NORTH C			
	MKD: "S"			
L&N	91918 - 527 BAGS - G 101500 T 47500 NET 54000			
L&N	91545 - 543 BAGS - G 100900 T 46700 NET 54200			
L&N	5152 - 475 BAGS - G 94100 T 46000 NET 48100			
L&N	108584 - 108 BAGS - G 66400 T 55800 NET 10600			

Subject to Section 7 of conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:

The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

(Signature of Consignor.)

If charges are to be prepaid, write or stamp here, "To be Prepaid."

COLLECT

Received $ to apply in prepayment of the charges on the property described hereon.

Agent or Cashier.

Per

(The signature here acknowledges only the amount prepaid.)

Charges Advanced:

*If the shipment moves between two ports by a carrier by water, the law requires that the bill of lading shall state whether it is "carrier's or shipper's weight."

NOTE—Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.

The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding per

N.D. CUNNINGHAM AND CO. Shipper. Hugh Justice, MCSA Agent

Per [signature] Per HWE

Permanent postoffice address of Shipper P.O. BOX 15, MOBILE, ALA.

CAPCO KIN 0000447

003207

DATE OF INVOICE	DIV.	AMOUNT	DISCOUNT	NET
6/30	1	3,825.00		3,825.00
6/30	1	22,500.00		22,500.00

STATEMENT OF REMITTANCE

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA

ACCEPTANCE OF THIS CHECK WILL BE CONSIDERED FULL PAYMENT OF ITEMS LISTED ON THIS VOUCHER.

APPROVED	MO	DAY	YR	TOTAL	VENDOR
	09	10	68	26,325.00	NORTH AMER ASBESTOS CORP

DETACH AND RETAIN FOR YOUR FILE

SEP 1968

NORTH AMERICAN ASBESTOS CORPORATION

200 SOUTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60604

TELEPHONE (312) 922-7435

INVOICE No. 6030

DATE August 30, 1968

SOLD TO

Cement Asbestos Products Company

Woodward, Alabama 35189

CUSTOMER ORDER NO. RM-58
Rel. No. 6F
OUR ORDER NO. 2152-6

SHIPPED TO
Cement Asbestos Company
c/o R. G. Jackson
Ragland, Alabama

SHIPPED VIA "Harry Clubreath" to Port of Mobile
L & N Rail to your plant

SHIPPING DATE August 30, 1968

QUANTITY	DESCRIPTION	PRICE	TOTAL
17 tons (340 bags)	Grade OWS Blue Fiber paper lined hessian bags	@ $ 225.00 per ton f. ob. Port of Mobile	$3,825.00
	Sixth and Final Shipment		
	TERMS: Net Ten Days		

2345

DATE APPROVED
PRICE & TERMS APPROVED
CALCULATIONS
CHECKED
TRANSPORTATION
407
MONTH
CHGD.
AMOUNT
MATERIAL REC'D
9-6-68
DATE
REC'D BY
CHARGE 9-5
LIST NO. 2
FINAL APPROVAL
APPROVED

EXEMPT FROM ALABAMA SALES OR USE TAX

GIVE SPECIAL ATTENTION

CAPCO KIN 0000449

SEP 1968

NORTH AMERICAN ASBESTOS CORPORATION

200 SOUTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60604

TELEPHONE (312) 922-7435

INVOICE No. 6031

DATE August 30, 1968

SOLD TO

Cement Asbestos Products Company

Woodward, Alabama 35189

"Harry Culbreath" to Port of Mobile

CUSTOMER ORDER NO. RM-65
Rel. No. 1
OUR ORDER NO. 2891-1

SHIPPED TO
Cement Asbestos Products Co.
c/o R. G. Jackson, S. K.
Ragland, Alabama

SHIPPED VIA L & N Rail to your plant

SHIPPING DATE August 30, 1968

QUANTITY	DESCRIPTION	PRICE	TOTAL
100 tons (2,000 bags)	Grade OWS Blue Fiber paper lined hessian bags	@ $225.00 per ton f. o. b. Port of Mobile	$22,500.00

EXEMPT FROM ALABAMA SALES OR USE TAX

ORDER APPROVED

PRICE & TERMS APPROVED

CALCULATIONS CHECKED

TRANSPORTATION

MATERIAL REC'D

CHARGE

LIST NO. 2

FINAL APPROVAL

9350

First Partial Shipment

GIVE SPECIAL ATTENTION AND PUSH FOR

TERMS: Net Ten Days

CAPCO KIN 0000450

PLACE SPECIAL SERVICE PASTERS HERE

FORM 147 REV. 2-68

~~712 Seaboard Coast Line~~ Railroad Company - 712

444 L&N 444

FREIGHT WAYBILL

TO BE USED FOR SINGLE CONSIGNMENTS, CARLOAD, LESS CARLOAD, AND TOFC

TRANSFERRED TO CAR	KIND	WEIGHT IN TONS GROSS	TARE	NET	LENGTH OF CAR ORDERED	FURNISHED	MARKED CAPACITY OF CAR ORDERED	FURNISHED
CAR INITIALS AND NUMBER 4 CARS SEE BELOW	KIND IMPORT							

TOFC TRAILER INITIAL AND NUMBER	LENGTH	PLAN NUMBER	
TOFC TRAILER INITIAL AND NUMBER	LENGTH	PLAN NUMBER	

DATE OF SHIPMENT: 9-25-68 REV WB 9-27-68

WAYBILL No.: 130418

CONSIGNEE AND ADDRESS AT STOP

STOP THIS CAR AT

AT

AT

TO No.	STATION	STATE OR PROV.
23305	RAGLAND	ALA

FROM No.	STATION	STATE OR PROV.
8440	MOBILE	ALA

ROUTE (Show each Junction and Carrier in route order to destination of waybill).

X L&N BGHAM SCL SCL DELY

Show "A" if Agent's Routing or "S" if Shipper's Routing

ROUTE CODE NO.

FULL NAME OF SHIPPER, AND, FOR C.O.D. SHIPMENTS, STREET, POST OFFICE ADDRESS, AND INVOICE NUMBER

NORTH AMERICAN ASBESTOS CORPN
"200 STH MICHIGAN AVE
CHIBAGO ILL EX TRY

CODE NO.

RECONSIGNED TO STATION STATE OR PROV.

ORIGIN AND DATE, ORIGINAL CAR, TRANSFER FREIGHT BILL AND PREVIOUS WAYBILL REFERENCE AND ROUTING WHEN REBILLED.

CONSIGNEE AND ADDRESS

CEMENT ASBESTOS PROD CO
ORDER NO RM 65 RELEASE NO 2

CODE NO.

FINAL DESTINATION AND ADDITIONAL ROUTING

INSTRUCTIONS PROTECTIVE SERVICE, MILLING, WEIGHING, ETC

AMOUNT

C. $..... FEE

O. $..... TOTAL

D. $.....

SEE BELOW WEIGHED

AT

GROSS

TARE

ALLOWANCE

NET

PICKUP SERVICE YES NO

DELIVERY SERVICE REQUESTED YES NO

IF CHARGES ARE TO BE PREPAID, WRITE OR STAMP HERE "TO BE PREPAID"

WHEN SHIPPER IN THE UNITED STATES EXECUTES THE NO-RECOURSE CLAUSE OF SECTION 7 OF THE BILL OF LADING, INSERT "YES".

ON L. C. L. TRAFFIC TRANSFER STAMPS TO BE SHOWN IN THIS SPACE

Indicate by symbol in Column provided ★ how weights were obtained for L. C. L. Shipments only. R — Railroad Scale, S — Shipper's Tested Weights, E — Estimated—Weigh and Correct, T — Tariff Classification or Minimum.

NO PKGS.	DESCRIPTION OF ARTICLES, SPECIAL MARKS AND EXCEPTIONS	COMMODITY CODE NO.	★	WEIGHT	RATE	FREIGHT	ADVANCES	PREPAID
	2000 BAGS BLUE CRUDE ASBESTOS	14 919 15		206900	95	1965.55		
	EX JAMES MCKAY B/L 3 DURBAN			WHFG	28BT		28.97	
				HANDLING	16 lnt		166.55	
							195 52	
	L&N 108592 → 704 Bags Gross	130 000		Tare 49300 Net		73100		
	SLSF 19846 558 Bags /	107 000		/ 49300 /		57700		
SSW	34283 535 BAGS	101600		46500	55100	COLLECT		
FWD	8267 203 /?/	67700		46700	21000	TRL CAR		

DESTINATION AGENT'S FREIGHT BILL No.

Inbound Junction Agent Will Show Junction Stamps in Space and Order Provided Additional Junction Stamps and all Yard Stamps to be Placed on Back Hereof.

FIRST JUNCTION	SECOND JUNCTION	THIRD JUNCTION	FOURTH JUNCTION
	C	O P	Y

DESTINATION AGENT WILL STAMP HEREIN STATION NAME AND DATE REPORTED

REV WB REC 10-3-6
TO JAX 10-4-68

712—SEABOARD COAST LINE RAILROAD COMPANY—712

CAPCO KIN 00004

BM Sets - 4-65

Form 3570

(Uniform Domestic Straight Bill of Lading, adopted by Carriers in Official, Southern, Western and Illinois Classification Territories, March 15, 1922, as amended August 1, 1930 and June 15, 1941.)

1st SHEET

UNIFORM STRAIGHT BILL OF LADING

ORIGINAL—NOT NEGOTIABLE

Shipper's No.

Agent's No.

Louisville & Nashville Railroad Company

RECEIVED, subject to the classifications and tariffs in effect on the date of the issue of this Bill of Lading,

at PIER: SO B # 3, A.S.D., MOBILE, ALA. XXXXXXXX SEPT. 5, 19 68

from NORTH AMERICAN ASBESTOS PRODUCTS , 200 SO. MICHIGAN AVE., CHICAGO, ILL.

the property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below, which said company (the word company being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its own road or its own water line, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the conditions not prohibited by law, whether printed or written, herein contained, including the conditions on back hereof, which are hereby agreed to by the shipper and accepted for himself and his assigns.

(Mail or street address of consignee—For purposes of notification only.)

Consigned to CEMENT ASBESTOS PRODUCTS CO.

Destination RAGLAND State of ALA. County of

Route L&N BIRMINGHAM SCL

(FOUR CARS - SEE BELOW)

Delivering Carrier SCL DELY Car Initial Car No.

No. Packages	DESCRIPTION OF ARTICLES, SPECIAL MARKS, AND EXCEPTIONS	*WEIGHT (Subject to Correction)	CLASS OR RATE	CHECK COLUMN
2,340	BAGS BLUE CRUDE ASBESTOS	~~236,340~~		
	17 tons included	236000		
NYC	215021 - 726 BAGS - G 128800 T 56300 NET 72500			
	SEALS: 8903-04			
L&N	46250 - 557 BAGS - G 112400 T 56300 NET 56100			
	SEALS: 8901-02			
CNW	34060 - ~~XXX~~ 542 BAGS - G 102400 T 48000 NET 54400			
	SEALS: 8907-08			
MSTL	4104 - 515 BAGS - G 99800 T 46800 NET 53000			
	SEALS: 8905-06			
	EX: HARRY CULBREATH, B/L 2,3, BURBAN			
	PIER: SO B # 3, A.S.D., MOBILE, ALA.			
	UKD: S B/L 2 S B/L 3			

Subject to Section 7 of conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:

The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

(Signature of Consignor.)

If charges are to be prepaid, write or stamp here. "To be Prepaid."

COLLECT

Received $ to apply in prepayment of the charges on the property described hereon.

Agent or Cashier.

(Per signature here acknowledges only the amount prepaid.)

TERMINAL RAILWAY, ALA.
STATE DOCKS, MOBILE, ALA
Cross
Tom (Mailed)
Tom (Mailed)

RECEIVED SEP 5 1968 L&N YARD OFFICE MOBILE ALA.

*If the shipment moves between two ports by a carrier by water, the law requires that the bill of lading shall state whether it is "carrier's or shipper's weight."

NOTE—Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.

The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

Charges Advanced:

$

per

N.D. CUNNINGHAM AND CO., INC. Shipper. Hugh Justice, MCSA HWE Agent

Per [signature] Per

Permanent postoffice address of Shipper P.O. BOX 15, MOBILE, ALA.

1

CAPCO KIN 0000452

003490

STATEMENT OF REMITTANCE

CEMENT ASBESTOS PRODUCTS COMPANY
WOODWARD, ALABAMA

ACCEPTANCE OF THIS CHECK WILL BE CONSIDERED FULL PAYMENT OF ITEMS LISTED ON THIS VOUCHER.

DATE OF INVOICE	DIV.	AMOUNT	DISCOUNT	NET
8/23	1	78750		78750
9/20	1	22,500 00		22,500 00

APPROVED

MO. 10 DAY 14 YR. 68 TOTAL 22,421 25 VENDOR NORTH AMER ASBESTOS CORP

DETACH AND RETAIN FOR YOUR FILE

CAPCO KIN 0000453

OCT 4 1968

OCT 3 1968

NORTH AMERICAN ASBESTOS CORPORATION

200 SOUTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60604

TELEPHONE (312) 922-7435

INVOICE No. 6068

DATE September 30, 1968

SOLD TO

Cement Asbestos Products Company

Woodward, Alabama 35189

CUSTOMER ORDER NO. RM-65
Rel. No. 2

OUR ORDER NO. 2191-2

SHIPPED TO

Cement Asbestos Products Co.
c/o R. G. Jackson, S.K.
Ragland, Alabama

SHIPPED VIA "James McKay" to Port of Mobile
L & N Rail to your plant

SHIPPING DATE September 20, 1968

QUANTITY	DESCRIPTION	PRICE	TOTAL
100 tons (2,000 bags)	Grade OWS Blue Fiber in paper lined hessian bags	@ $225.00 per ton f. o. b. vessel Port of Mobile	$22,500.00
	Second Partial Shipment		
	TERMS: Net Ten Days		

DATE APPROVED

PRICE & TERMS APPROVED

CALCULATIONS

MONTH

CHGD.

AMOUNT

MATERIAL REC'D

DATE

REC'D BY

CHARGE

GIVE SPECIAL ATTENTION

AND USE FOR

SHIPMENT

CAPCO KIN 0000454

NORTH AMERICAN ASBESTOS CORPORATION

200 SOUTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60604

TELEPHONE (312) 922-7435

INVOICE **No** 6103

DATE October 31, 1968

CUSTOMER ORDER NO. RM-

OUR ORDER NO. 2224

SOLD TO

Cement Asbestos Products Company

Woodward, Alabama 35189

SHIPPED TO

Cement Asbestos

Ragland, Alabama

SHIPPED VIA KMA Enterprizes

SHIPPING DATE October 8, 1968

QUANTITY	DESCRIPTION	PRICE	TOTAL
30 tons (600 bags)	Grade S Blue Fiber	@ $ 243.00 per ton f. o. b. New Orleans	$ 7,290.00
	Order Shipped Complete		
	TERMS: Net Ten Days		

003766

STATEMENT OF REMITTANCE

CEMENT ASBESTOS PRODUCTS COMPANY

WOODWARD, ALABAMA

ACCEPTANCE OF THIS CHECK WILL BE CONSIDERED FULL PAYMENT OF ITEMS LISTED ON THIS VOUCHER.

DATE OF INVOICE	DIV.	AMOUNT	DISCOUNT	NET
11/06	1	22,196 25		22,196 25

APPROVED

MO. 11 DAY 18 YR. 08

TOTAL 22,196 25

VENDOR NORTH AMER ASBESTOS CORP

DETACH AND RETAIN FOR YOUR FILE

NOV 8 1968

NORTH AMERICAN ASBESTOS CORPORATION

200 SOUTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60604

TELEPHONE (312) 922-7435

INVOICE **No. 6119**

DATE November 6, 1968

SOLD TO

Cement Asbestos Products Company

Woodward, Alabama 35189

CUSTOMER ORDER NO. RM-65
Rel. No. 3
OUR ORDER NO. 2191-3

SHIPPED TO
Cement Asbestos Products Co.
c/o R. G. Jackson, S.K.
Ragland, Alabama

SHIPPED VIA L & N to your plant

SHIPPING DATE November 4, 1968

QUANTITY	DESCRIPTION	PRICE	TOTAL
~~100~~ 98.56 tons (2,000 bags)	Grade OWS Blue Fiber paper lined hessian bags	@ $ 225.00 per ton f.o.b. vessel Port of Mobile	~~$22,500.00~~ 22,196.25
	Third Partial Shipment		
	TERMS: Net Ten Days		

11/11

11-14-68

9-5

LIST NO. 2

FINAL APPROVAL

GIVE SPECIAL ATTENTION AND RUSH FOR DISCOUNT

11-16

CAPCO KIN 0000457

CEMENT ASBESTOS PRODUCTS COMPANY

WOODWARD, ALABAMA

INVOICE CORRECTION NOTICE

Ragland WORKS 11-14 19 68

North American Asbestos Corp.

Chicago, Ill. 60604

SHIPMENT MADE ON

OUR ORDER NUMBER RM-65

YOUR INVOICE No. 6119 DATED 11-6 19 68 FOR . . . . . $ 22,500.00

HAS BEEN CORRECTED TO READ . . . . . $ 22,196.25

DIFFERENCE (SHOW DEBIT OR CREDIT) . . . . . Debit 303.75

THIS CORRECTION ISSUED ON ACCOUNT:

The shipment was short 27 bags.
Received only 98.46 tons

DO NOT SEND CORRECTED INVOICE OR CREDIT MEMORANDUM.

CEMENT ASBESTOS PRODUCTS COMPANY

BY R. G. Jackson

CAPCO KIN 0000458

2639C REV. 1/68

SHORT FORM BILL OF LADING—ORIGINAL—NOT NEGOTIABLE

444 — LOUISVILLE & NASHVILLE RAILROAD COMPANY — 444

RECEIVED, subject to the classifications and tariffs in effect on the date of the issue of this Bill of Lading

the property described below in apparent good order except as noted (contents and condition of contents of packages unknown) marked consigned and destined as indicated below which said company (the word company being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination if on its own road or its own water line, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed as to each carrier of all or any of said property over all or any portion of said route to destination and as to each party at any time interested in all or any of said property that every service to be performed hereunder shall be subject to all the conditions not prohibited by law whether printed or written herein contained including the conditions on back hereof, which are hereby agreed to by the shipper and accepted for himself and his assigns.
(Mail or street address of consignee—For purposes of notification only)

C. L. TRANSFERRED TO	KIND	WEIGHT IN TONS			LENGTH OF CAR		MARKED CAPACITY OF CAR	
		GROSS	TARE	NET	ORDERED	FURNISHED	ORDERED	FURNISHED
CAR INITIAL AND NUMBER (FOUR CARS - SEE BELOW)					DATE		WAYBILL NO.	
TRAILER NUMBER			PLAN NUMBER					
TRAILER NUMBER								

STOP THIS AT ~~CEMENT ASBESTOS PRODUCTS CO~~
CAR AT ~~RAGLAND, ALA~~

CONSIGNEE AND ADDRESS AT STOP ~~CEMENT ASBESTOS PRODUCTS CO~~

FROM NO. STATION STATE OR PROV.

BILL OF LADING DATE	BILL OF LADING NO	INVOICE NO.	CUSTOMERS NO
10/7/68	1	COMM'L. 10/11/68	

CONSIGNED TO (Mail or Street Address of Consignee—For purposes of Notification only.)
CEMENT ASBESTOS PRODUCTS CO.
RAGLAND, ALA.

FULL NAME OF SHIPPER: NORTH AMERICAN ASBESTOS CORP.
CODE NO.

DESTINATION: RAGLAND, ALA.
STATE OF
COUNTY OF

ROUTE DESIGNATED BY SHIPPER: L&N BHAM SCL

SHIPPER'S SPECIAL INSTRUCTIONS

Subject to Section 7 of conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement: The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.
Signature of Consignor

NOTE—Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property. The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding
PER

TERMINAL RAILROAD ASSN. ALA.
TRUE DOCKS, MOBILE, ALA
AT
GROSS
TARE
ALLOWED
NET
Capacity
AUTHORITY of S. W. and I. B

Agent N.D. CUNNINGHAM AND CO
Per

IF CHARGES ARE TO BE PREPAID WRITE OR STAMP HERE

Shipper NORTH AMERICAN ASBESTOS CORP.

Permanent Post Office Address of Shipper 200 SO. MICHIGAN AVE., CHICAGO, ILL.

Indicate by symbol in column provided ★ how weights tested were obtained for L. C. L. Shipments only. R—Railroad Scale, S—Shippers Tested Weights, E—Estimated - Weigh and Correct T—Tariff classification or minimum.

NO. PKGS	DESCRIPTION OF ARTICLES SPECIAL MARKS AND EXCEPTIONS	COMMODITY CODE NO	★	WEIGHT	RATE	FREIGHT	ADVANCES	PREPAID
2,000	PAPER LINED HESSIAN BAGS BLUE CRUDE ASBESTOS			~~[illegible]~~ 198900				

B&O 474725 - 616 BAGS - G 125700 TARE 63700 NET 62000
MP 81639 - 616 BAGS - G 116200 TARE 54600 NET 61600
CB&Q 61486 - 500 BAGS - G 94100 TARE 45400 NET 48700
WM 29194 - 268 BAGS - G 76700 TARE 50100 NET 26600 TRLR CAR

EX: RUTH LYKES, B/L 1, DURBAN
PIER: NO.C, A.S.D., MOBILE, ALA.
MKD: "S"

RECEIVED NOV 8 1968 L&N YARD OFFICE MOBILE ALA

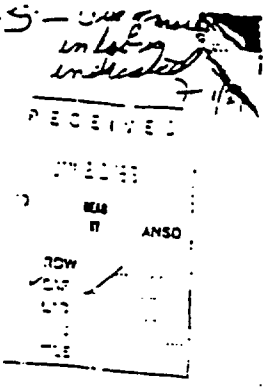
444 — LOUISVILLE & NASHVILLE RAILROAD COMPANY — 44

CAPCO KIN 000045

CC D Weaver mark confid

CC CES — [illegible] in [illegible] indicated

RECEIVED



January 18, 1968

Mr. M. J. Messel
Lake Asbestos of Quebec

In a "1968 Notice of Intent" the American Conference of Industrial Hygienists Committee on Threshold Limits announces a change in the listing of the limit for asbestos dust in the air of work places.

The limit of 5 million particles per cubic foot of air will be the same as before but a note in the Appendix will read:

"A limit of 5 mppcf, based on impinger samples counted by light-field technics, is satisfactory to control exposures to most forms of asbestos. Crocidolite, however, has been shown to produce, in addition to the asbestotic inflammation, also mesothelioma. Since no safe limit can be established for this form of asbestos at this time, until more definitive data are obtained, it is recommended that workers exposed to crocidolite be equipped with air-supplied helmets."

It seems to me this note does us no harm and perhaps some good.

K. W. Nelson

KWN/mb

cc: D. H. Soutar
E. A. Farrell

INDUSTRIAL VENTILATION

A Manual of Recommended Practice

Our Edition

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS

CAPCO KIN 0000461

INDUSTRIAL VENTILATION

A Manual of Recommended Practice

COMMITTEE ON INDUSTRIAL VENTILATION
P. O. BOX 453
LANSING, MICHIGAN, 48902, U.S.A.

American Conference of Governmental Industrial Hygienists

Manual		*Calculation Sheets*
U.S.A.	Outside U.S.A.	$2.00 — 25 copies
$5.00 — copy	$6.00 — copy	4.00 — 100 copies
2.50 — 15 or more copies	4.50 — 15 or more copies	

CAPCO KIN 0000462

TABLE OF CONTENTS

	Page
FOREWORD	V
ACKNOWLEDGMENTS	VII
INTRODUCTION	IX
DEFINITIONS	XI
ABBREVIATIONS	XIII
GENERAL PRINCIPLES OF VENTILATION—Section 1	1-1
Principles of Air Flow	
Pressure Drop Through Ductwork	
Effective Specific Gravity	
Air Flow Characteristics of Blowing and Exhausting	
Make-Up Air	
DILUTION VENTILATION—Section 2	2-1
Dilution Ventilation for Health	
Dilution Ventilation for Fire and Explosion	
Dilution Ventilation for Mixtures	
VENTILATION FOR HEAT CONTROL—Section 3	3-1
Physiological Principles	
Control Methods	
HOOD DESIGN—Section 4	4-1
Introduction	
Principles of Hood Design	
Range of Capture Velocities	
Capture of Velocities for Specific Operations	
Hood Design Procedure	
Hood Design for Radioactive Materials	
SPECIFIC OPERATIONS—Section 5	5-1
Specific Hood Designs	
[illegible] PROCEDURE—Section 6	6-1
Preliminary Steps	
Methods of Calculation	
Methods of Design	
Method A—Balanced System	
Method B—Blast Gate System	
Correction for Temperature and Elevation	
[illegible] Pressure	
[illegible] Type Exhaust Systems	
Velocity Pressure Design Method	
[illegible] AND RECIRCULATED AIR—Section 7	7-1
[illegible] of Make-up Air	
[illegible] Make-up Air	
[illegible] Calculations	
[illegible] of Air from Industrial Exhaust Systems	
[illegible] SPECIFICATIONS—Section 8	8-1
[illegible] Materials	
[illegible] VENTILATION SYSTEMS—Section 9	9-1
[illegible] of Air Flow	
[illegible] of Pressures	
[illegible] Systems	
[illegible] on Discharge Stacks	
[illegible] 10	10-1
[illegible]	
[illegible]	
[illegible] and Maintenance	
[illegible]	
[illegible]	
[illegible] DEVICES—Section 11	11-1
[illegible] Collection Equipment	
[illegible] Types	
[illegible] Cost	
[illegible] Materials	
[illegible] Comparison	
[illegible]	12-1
[illegible]	13-1
[illegible]	
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[illegible]	14-1

CAPCO KIN 0000463

FOREWORD

In this revision for the Twelfth Edition, the Committee on Industrial Ventilation, American Conference of Governmental Industrial Hygienists, has attempted to keep abreast of new developments and standards for industrial ventilation systems. A critical review has been made of the previous edition, modifying and rewriting certain portions for improved clarity and accuracy.

The committee continues its policy of presenting the material in a practical, concise, easy-to-understand manner. Theoretical discussions and complex equations are not given. The manual is sufficiently complete so that an industrial ventilation system can be designed without reference to other texts.

New material and revisions include:

SECTION 3 - Ventilation for Heat Control

The information relating to radiant heat as a factor in calculating effective temperature has been revised to clarify the procedure.

SECTION 4 - Hood Design Data

Additional information is given explaining the proper selection of exhaust Capture Velocity. Slot hood design factors and limitations are discussed.

SECTION 5 - Specific Operations

Specific design data with new drawings is presented for Low Volume-High Velocity exhaust systems. The [illegible] design data has been up-dated to correspond to the new Federal Occupational Safety and [illegible]. Nineteen other drawings of exhaust hood designs have been revised.

SECTION 6 - Duct Design Procedure

The method for evaluating duct velocity changes and the corresponding static pressure corrections has been revisited for better comprehension. A detailed explanation of Fan Static Pressure and Fan Total Pressure is presented. Air density correction data has been extended. Design data for duct expansions and evasé discharges has been revised.

SECTION 7 - Oil and gas fuels data and calculations have been extended to include flue gas composition by [illegible].

SECTION 8 - Fans

[illegible] illustrates fan performance in series and parallel operation. Revised discussion of fan [illegible] standard air.

[illegible] - Current Threshold Limit Values for Airborne Contaminants are presented.

[illegible] separately [illegible]:

1. The new Ventilation System Testing Guide describes the standard test method for testing an industrial ventilation system and includes the necessary charts, tables, data sheets and formulae.
2. [illegible] Supplement comprises a set of tables, graphs and charts in metric units which can be used to [illegible] the English charts in the Standard ventilation manual to enhance its use worldwide.
3. [illegible] and programs for designing industrial exhaust systems are available.

COMMITTEE ON INDUSTRIAL VENTILATION

M. M. Schuman, Michigan, Chairman
J. C. Barrett, Michigan
J. R. Lynch, U.S.P.H.S.
R. H. Wolle, Tennessee
R. P. Hibbard, Washington
L. Dickie, Consultant
C. M. Hama, Consultant

CAPCO KIN 0000464

DEFINITIONS

Aerosol: An assemblage of small particles, solid or liquid, suspended in air. The diameter of the particles may vary from 100 microns down to 0.01 micron or less, e.g., dust, fog, smoke.

Air Cleaner: A device designed for the purpose of removing atmospheric air-borne impurities such as dusts, gases, vapors, fumes and smokes. (Air cleaners include air washers, air filters, electrostatic precipitators and charcoal filters.)

Air Filter: An air cleaning device to remove light particulate loadings from normal atmospheric air before introduction into the building. Usual range: Loadings up to 3 grains per thousand cubic feet (0.003 grains per cubic foot). Note: Atmospheric air in heavy industrial areas and in-plant air in many industries have higher loadings than this and dust collectors are then indicated for proper air cleaning.

Air Horsepower: The theoretical horsepower required to drive a fan if there were no losses in the fan, that is, if its efficiency were 100%.

Air, Standard: Dry air at 70 F and 29.92 in (Hg) barometer. This is substantially equivalent to 0.075 lb/cu ft.

Aspect Ratio: The ratio of the width to the length. $AR = \frac{W}{L}$

Aspect Ratio of an Elbow: The width (W) along the axis of the bend divided by depth (D) in plane of bend. $AR = \frac{W}{D}$

Blast Gate: Sliding damper.

Blow (Throw): In air-distribution, the distance an air stream travels from an outlet to a position at which air moving along the axis reduces to a velocity of 50 fpm. For unit heaters, the distance an air stream travels from a heater without a perceptible rise due to temperature difference and loss of velocity.

Brake Horsepower: The horsepower actually required to drive a fan. This includes the energy losses in the fan and can be determined only by actual test of the fan. (This does not include the drive losses between motor and fan.)

Capture Velocity: The air velocity at any point in front of the hood or at the hood opening necessary to overcome opposing air currents and to capture the contaminated air at that point by causing it to flow into the hood.

Coefficient of Entry: The actual rate of flow caused by a given hood static pressure compared to the theoretical rate which would result if the static pressure could be converted to velocity pressure with 100% efficiency. It is the ratio of actual to theoretical flow.

Comfort Range (Average): The range of effective temperatures over which the majority (50 per cent or more) of adults feel comfortable.

Convection: The motion resulting in a fluid from the differences in density and the action of gravity. In ventilation this meaning has been extended to include both forced and natural motion or circulation.

Density: The ratio of the mass of a specimen of a substance to the volume of the specimen. The mass of a unit volume of a substance. Weight can be used without confusion, as synonymous with mass, density being the weight of a unit volume of a substance.

Density Ratio: The ratio of actual air density to density of standard air. The product of the density ratio and density of standard air (0.075 lb cu ft) will give the actual air density in lbs per cu ft.

Density: Actual density of air, lbs per cu ft.

Dust: Finely divided solid particles created by the breaking up of larger particles by processes such as crushing, grinding, blasting, explosions, etc. Dust particles already in existence in a mixture of materials may escape into the air through such operations as shoveling, conveying, screening, sweeping, etc.

Dust Collector: An air cleaning device to remove heavy particulate loadings from exhaust systems before recirculation. Usual range: Loadings 0.003 grains per cubic foot and higher.

CAPCO KIN 0000465

Entry Loss: Loss in pressure caused by air flowing into a duct or hood. (Inches H_2O).

Fumes: Small solid particles formed by the condensation of vapors of solid materials.

Gases: Formless fluids which tend to occupy an entire space uniformly at ordinary temperatures and pressures.

Gravity, Specific: The ratio of the mass of a unit volume of a substance to the mass of the same volume of a standard substance at a standard temperature. Water at 39.2 F is the standard substance usually referred to. For gases, dry air, at the same temperature and pressure as the gas, is often taken as the standard substance.

Hood: A shaped inlet designed to capture contaminated air and conduct it into the exhaust duct system.

Humidity, Absolute: The weight of water vapor per unit volume, pounds per cubic foot or grams per cubic centimeter.

Humidity, Relative: The ratio of the actual partial pressure of the water vapor in a space to the saturation pressure of pure water at the same temperature.

Inch of Water: A unit of pressure equal to the pressure exerted by a column of liquid water one inch high at a standard temperature.

Lower Explosive Limit: The lower limit of flammibility or explosibility of a gas or vapor at ordinary ambient temperatures expressed in per cent of the gas or vapor in air by volume. This limit is assumed constant for temperatures up to 250 F. Above these temperatures, it should be decreased by a factor of 0.7 since explosibility increases with higher temperatures.

Manometer: An instrument for measuring pressure; essentially a U-tube partially filled with a liquid, usually water, mercury or a light oil, so constructed that the amount of displacement of the liquid indicates the pressure being exerted on the instrument.

Micron: A unit of length, the thousandth part of 1 mm or the millionth of a meter, (approximately 1/25,0 of an inch).

Mists: Small droplets of materials that are ordinarily liquid at normal temperature and pressure.

Plenum: Pressure equalizing chamber.

Pressure, Atmospheric: The pressure due to the weight of the atmosphere. It is the pressure indicated by a barometer. Standard Atmospheric Pressure or Standard Atmosphere is the pressure of 29.92 inches of mercury.

Pressure, Static: The potential pressure exerted in all directions by a fluid at rest. For a fluid in motion it is measured in a direction normal to the direction of flow. Usually expressed in inches water gauge when dealing with air. (The tendency to either burst or collapse the pipe.)

Pressure, Total: The algebraic sum of the velocity pressure and the static pressure (with due regard to sign).

Pressure, Vapor: The pressure exerted by a vapor. If a vapor is kept in confinement over its liquid so that the vapor can accumulate above the liquid, the temperature being held constant, the vapor pressure approaches a fixed limit called the maximum or saturated vapor pressure, dependent only on the temperature and the liquid. The term vapor pressure is sometimes used as synonymous with saturated vapor pressure.

Pressure, Velocity: The kinetic pressure in the direction of flow necessary to cause a fluid at rest to flow at a given velocity. Usually expressed in inches water gauge.

Radiation, Thermal (Heat) Radiation: The transmission of energy by means of electromagnetic waves of very long wave length. Radiant energy of any wave length may, when absorbed, become thermal energy and result in an increase in the temperature of the absorbing body.

Slot Velocity: Linear flow rate of contaminated air through slot, fpm.

Smoke: An air suspension (aerosol) of particles, usually but not necessarily solid, often originating in a solid nucleus, formed from combustion or sublimation.

Temperature, Effective: An arbitrary index which combines into a single value the effect of temperature, humidity and air movement on the sensation of warmth or cold felt by the human body. The numerical value is that of the temperature of still, saturated air which would induce an identical sensation.

CAPCO KIN 0000466

Temperature, Wet-Bulb: Thermodynamic wet-bulb temperature is the temperature at which liquid or solid water, by evaporating into air, can bring the air to saturation adiabatically at the same temperature. Wet-bulb temperature (without qualification) is the temperature indicated by a wet-bulb psychrometer constructed and used according to specifications.

Threshold Limit Values (TLV): The values for air borne toxic materials which are to be used as guides in the control of health hazards and represent time weighted concentrations to which nearly all workers may be exposed 8 hours per day over extended periods of time without adverse effects. (See Appendix)

Transport (Conveying) Velocity: Minimum air velocity required to move the particulates in the air stream, fpm.

Vapor: The gaseous form of substances which are normally in the solid or liquid state and which can be changed to these states either by increasing the pressure or decreasing the temperature. Vapors diffuse.

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ABBREVIATIONS

A . . . . . Area
AHP . . . . . Air horsepower
acfm . . . . . actual cfm
AR . . . . . Aspect ratio
B . . . . . barometric pressure
bhp . . . . . Brake horsepower
btu . . . . . British thermal unit
btuh . . . . . btu/hr
C_e . . . . . Coefficient of entry
cfm . . . . . Cubic feet per minute
cu ft . . . . . Cubic foot
d . . . . . Density factor
D . . . . . Diameter

ET . . . . . Effective temperature
F . . . . . Degree, Fahrenheit
fpm . . . . . Feet per minute
fps . . . . . Feet per second
g . . . . . Gravitational force, ft/sec/sec
gpm . . . . . Gallons per minute
gr . . . . . Grains
h_e . . . . . Hood entry loss
hp . . . . . Horsepower

hr . . . . . Hour
in . . . . . Inch
LEL . . . . . Lower explosive limit
ME . . . . . Mechanical efficiency
mg . . . . . milligram
MRT . . . . . Mean radiant temperature
mm . . . . . Millimeter

min . . . . . Minute
MW . . . . . Molecular Weight
ppm . . . . . Parts per million
lb . . . . . Pound
psi . . . . . Pounds per square inch
Q . . . . . Quantity of air, cfm
RH . . . . . Relative humidity
ρ . . . . . Density of air in lb/cu ft

rpm . . . . . Revolutions per minute
SFM . . . . . Surface feet per minute
sq ft . . . . . Square foot
sq in . . . . . Square inch
SP . . . . . Static pressure
SP_h . . . . . Hood static pressure
scfm . . . . . Cfm at standard air conditions
sp gr . . . . . Specific gravity
STP . . . . . Standard temperature and pressure
TLV . . . . . Threshold Limit Values
TP . . . . . Total pressure
V . . . . . Velocity, fpm
VP . . . . . Velocity pressure
wg . . . . . Water gauge

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GENERAL PRINCIPLES OF VENTILATION

Principles of Air Flow

The flow of air between two points is due to the occurrence of a pressure difference between the two points. This pressure difference results in a force on the air, causing air flow from the high pressure zone to the low pressure zone. The quantity of air flow (Q) and the velocity of flow (V) are related according to the equation

$$Q = AV$$

where: Q = volume, cubic feet per minute
A = cross sectional area through which the air flows in square feet
V = velocity in lineal feet per minute

This basic relationship describes the flow of air under all conditions.

Air traveling at a specific velocity will create a definite pressure which is known as the Velocity Pressure. There is a definite relationship between the velocity of air and the Velocity Pressure. The basic statement of this relationship is

$$v = \sqrt{2gh}$$

where: v = velocity, feet per second
g = gravitational acceleration, feet per second per second
h = head of air, feet

When g = 32.2 ft/sec^2 and air density is 0.075 pounds per cubic foot, this formula converts to

$$V = 4005\sqrt{VP}$$

where: V = air velocity, feet per minute
VP = velocity pressure, inches of water

It must be emphasized that Velocity Pressure is always exerted in the direction of air flow.

Air confined within an enclosure, whether in motion or not, creates another type of pressure which exerts itself equally and perpendicularly to the walls of the enclosure. This pressure is known as Static Pressure and it is measured independent of the velocity of the air.

When Static Pressure is below atmospheric pressure it is negative. When it is above atmospheric pressure it is positive. Velocity Pressure is always positive.

The algebraic sum of Static Pressure and Velocity Pressure is Total Pressure. This may also be written in the form of a formula—the symbols are those used throughout this book:

$$TP = SP + VP$$

Practical evidence of these pressures can be demonstrated under actual conditions. For example, assume a test chamber (sealed) containing air pressure of 0.05 pounds per square inch. This 0.05 psi pressure is equivalent to a static pressure of 1.39 inches of water. If a small hole is drilled into this chamber and a U-tube is used, a reading of 1.39 inches of water will result. (1 psi = 27.7 inches of water.) Since there is no air flow, the velocity pressure will be zero and the total pressure will be 1.39 inches of water. This is shown in Figure 1-1.

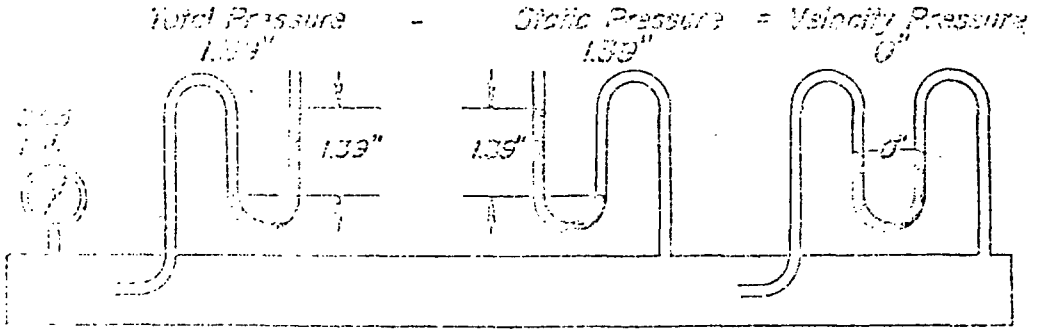

Fig. 1-1

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If the ends of this chamber are opened, it becomes a duct through which air may flow. With air flowing through this duct there can exist two distinct pressures, namely, static pressure and velocity pressure. The algebraic sum of these two pressures is called total pressure. If a fan is placed so that air is blown through the duct, the pressures shown in Figure 1-2 could result.

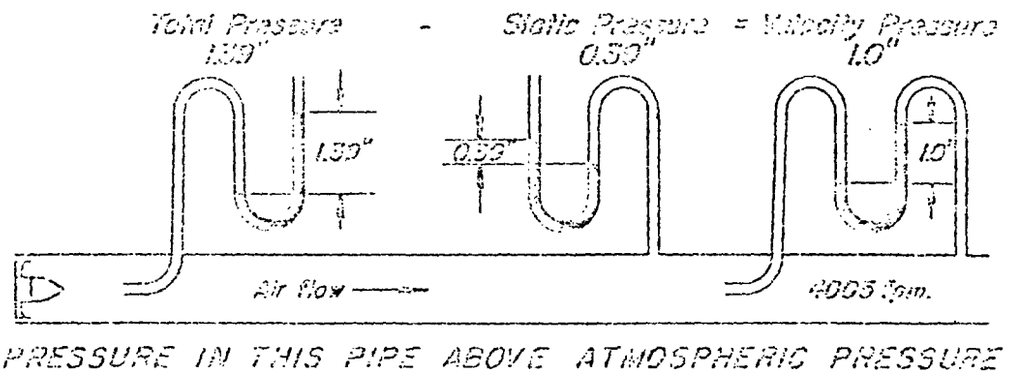

Fig. 1-2

If a fan is placed so that air is drawn through the duct, the pressures indicated in Figure 1-3 could result.

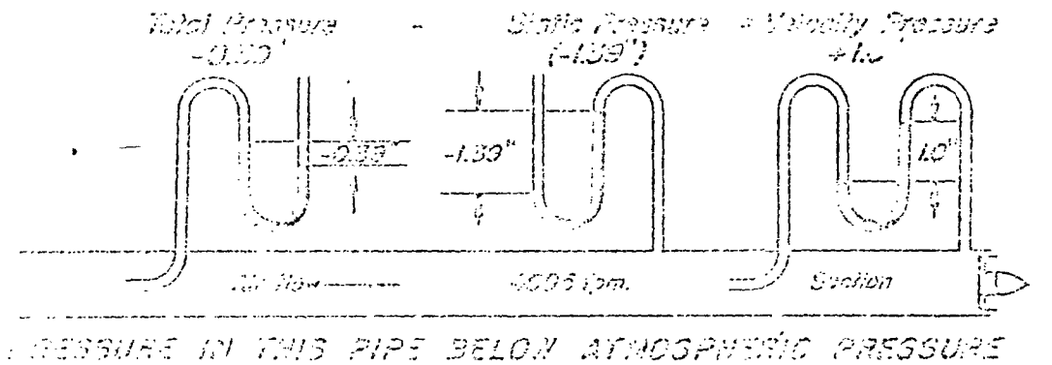

Fig. 1-3

[illegible] total, static and velocity pressures are shown in a long section of exhaust duct equipped [illegible] hood.

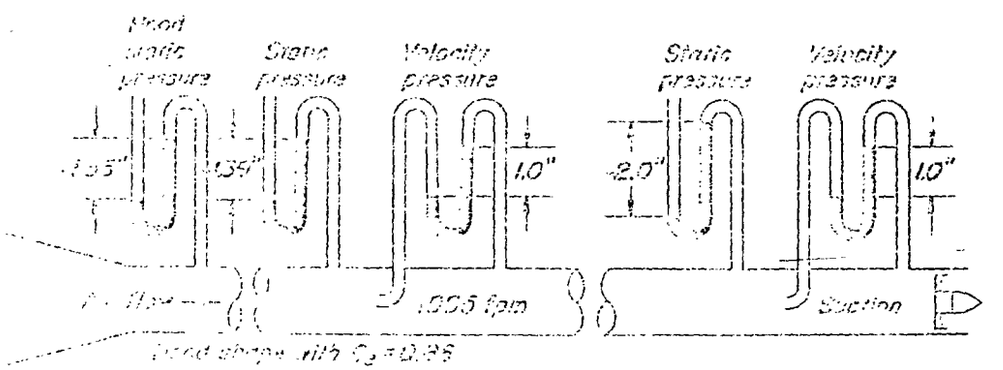

Fig. 1-4

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Acceleration of Air and Hood Entrance Losses

The pressure difference required to move air into an opening may not be sufficient to both accelerate the air from rest to a velocity and to overcome the turbulence losses at the opening.

For acceleration, the energy required is equal to the Velocity Pressure corresponding to the velocity.

Turbulence losses are caused by the opening and vary with the shape of opening. The coefficient of entry (C_e) indicates the extent of turbulence losses. In a theoretically perfect hood with no turbulence loss, $C_e = 1.0$.

Hood Static Pressure (SP_h) is a direct measurement, in inches of water, of both the acceleration energy and turbulence losses. For a perfect hood with no turbulence loss, $C_e = 1.0$ and $SP_h = VP$ (See Section 4). In this case:

$$V = 4005\ C_e \sqrt{SP_h} = 4005 \sqrt{SP_h}$$

For the hood shown in Figure 1-4 where $C_e = 0.86$ this becomes:

$$V = 4005\ C_e \sqrt{SP_h} = 4005 \times 0.86 \sqrt{SP_h} = 3444 \sqrt{SP_h}$$

To obtain the desired velocity, 4005 fpm, the required SP_h can be calculated from the above formula:

$$\sqrt{SP_h} = \frac{V}{3444} = \frac{4005}{3444}$$

$$SP_h = \left(\frac{4005}{3444}\right)^2 = 1.35 \text{ inches of water}$$

As previously stated, the hood static pressure indicates both the acceleration (VP) and hood entrance losses (h_e). This may be expressed as

$$SP_h = VP + h_e$$

For design purposes the entry loss (h_e) is often designated as a decimal fraction (F_h) of the velocity pressure (VP). In this form it applies to air velocities.

$$h_e = F_h VP$$

(See Section 4, Figure 4-3; Section 5; Section 6, Figure 6-10.)

Pressure Drop Through Ductwork

Air flowing through ducts encounters resistance to flow due to (1) friction losses and (2) dynamic (turbulence) losses. Friction losses are caused by the actual rubbing of the air against the surfaces of the duct. Dynamic losses result due to air turbulence which takes place whenever air flow through a duct changes direction or velocity; i.e., whenever the duct changes direction or varies in cross-sectional area. The result of friction and dynamic losses is to cause a pressure drop to occur as the air flows through a duct.

The well known Bernoulli's Theorem frequently used in flow of fluids is merely a statement of the laws of conservation of energy. Bernoulli's Theorem as applied to air is: static pressure plus velocity pressure at a point upstream in direction of air flow is equal to the static pressure plus velocity pressure at a point downstream in direction of air flow plus the friction and dynamic losses:

$$SP_1 + VP_1 = SP_2 + VP_2 + \text{losses}$$

For practical purposes, the total amount of friction through any round duct varies directly as the length, inversely as the diameter of the duct and directly as the square of the velocity of air flowing through the duct. The pressure drop through a duct system due to dynamic losses depends upon (1) number and type of elbows installed and (2) the frequency with which the velocity of air changes as it flows through the duct system.

In order to overcome the resistances of a duct system, it is necessary to expend energy in maintaining a pressure differential between the two ends of the system. This is usually accomplished by the use of a fan. The fan delivers air at a static pressure great enough to overcome the resistance of the system. Figure 1-5 is a graphical description of actual pressure changes in a simple exhaust system.

Significance of Specific Gravity

Frequently, the location of exhaust hoods is mistakenly based on a supposition that the contaminant is "lighter than air" or "heavier than air." In most health hazard applications, this criterion is of little value. Most dust, fumes, vapors and gases are truly air-borne, following air currents and are not subject to any tendency in motion either upward or downward because of their own density. For example, consider the

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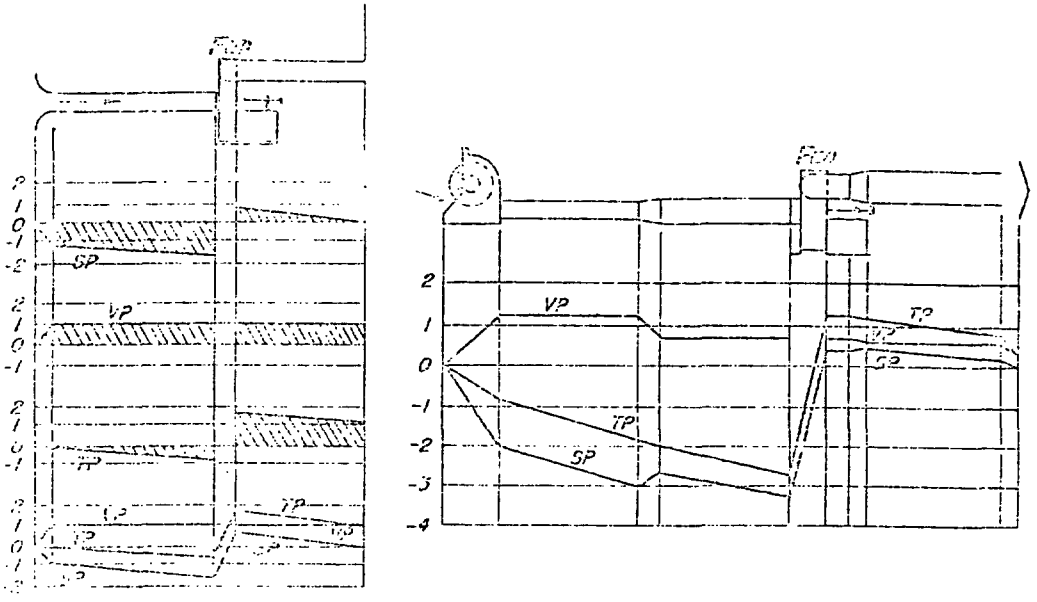

Fig. 1-5

degreasing solvent, perchloroethylene (tetrachloroethylene). Assuming the perchloroethylene vapor is well mixed with air, the following calculations indicate the effective specific gravity of a 10,000 ppm perchloroethylene-air mixture.

Specific gravity of air = 1
Specific gravity of C_2Cl_4 = 5.7
10,000 ppm = 1 part C_2Cl_4 : 99 parts of air
0.01 x 5.7 = 0.057
0.99 x 1.0 = 0.990
1.047 = effective specific gravity of mixture

Since 10,000 ppm is 100 times the TLV value of perchloroethylene, the mixture normally encountered [illegible] much less than 10,000 ppm. By a similar calculation a 100 ppm perchloroethylene-air mixture [illegible] effective specific gravity of 1.0005.

[illegible], the perchloroethylene-air mixtures compared to clean air would have a tendency to move downward [illegible] by the ratio of 105/100 in the case of the 10,000 ppm mixture or 10005/10000 in the case of the [illegible] ppm mixture and not by the ratio of 5.7/1 as is frequently implied. Thus the effects of window ventilation [illegible] currents, traffic and heat can dwarf into insignificance the effect of specific gravity. A vapor of high [illegible] gravity has been chosen for illustration; obviously the influence of specific gravity will be even less in the case of those gases and vapors whose specific gravity is closer to the specific gravity of air.

[illegible] Characteristics of Blowing and Exhausting

[illegible] from a small opening retains its directional effect for a considerable distance beyond the plane of the opening. However, if the flow of air through the same opening were reversed so that it operated as an exhaust opening handling the same volume of air, the flow would become almost completely non-directional and [illegible] of influence would be greatly reduced. For this reason, local exhaust hoods must not be contemplated for any process which cannot be conducted in the immediate vicinity of the hood. Figure 1-6 illustrates the fundamental difference between blowing and exhausting.

[illegible]

[illegible] systems will require a mechanical system of supplied air to offset the air exhausted. For [illegible] discussion of design, refer to Section 7, "Make-Up and Recirculated Air."

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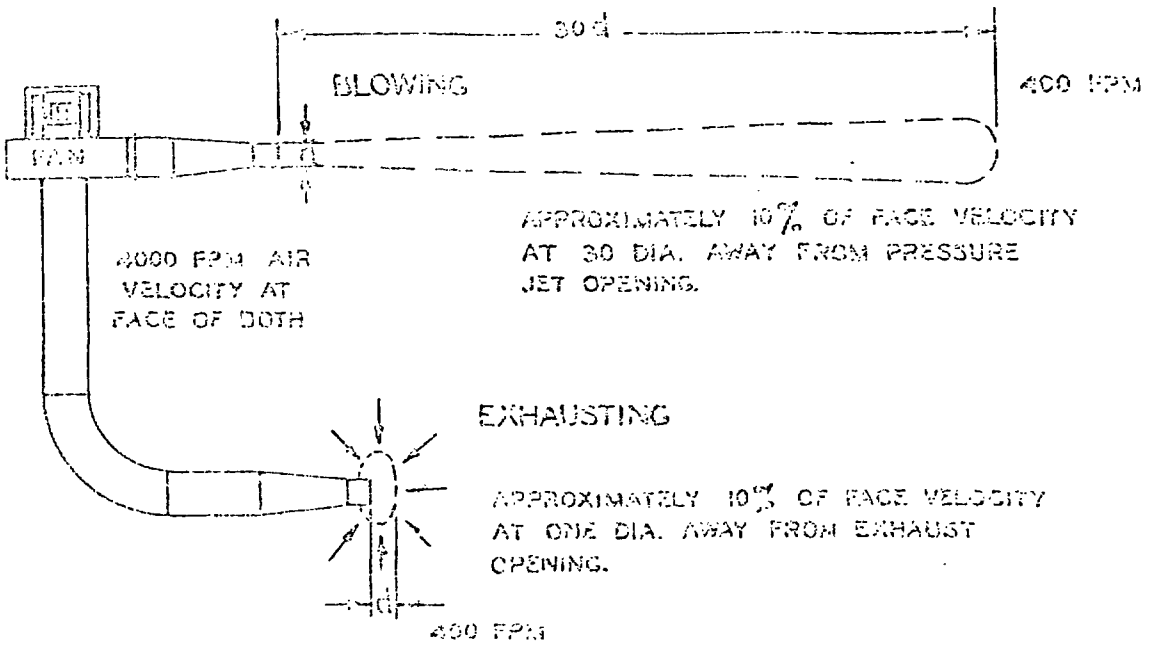

Fig. 1-6

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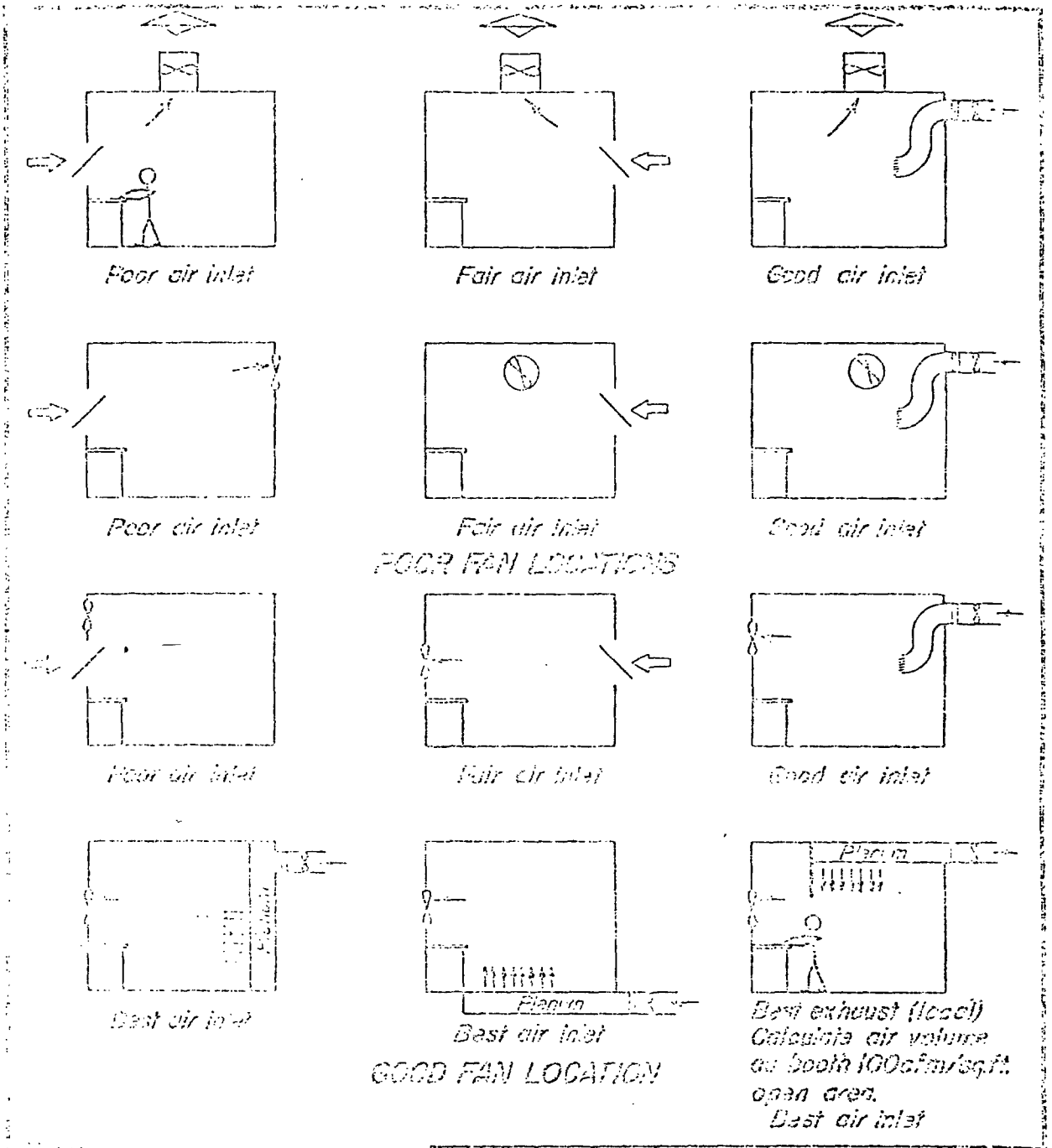

Note:
Inlet air requires tempering during winter months.
See Section 7

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PRINCIPLES OF DILUTION VENTILATION

DATE 1-66 | Fig. 2-1

Section 4

HOOD DESIGN DATA

Introduction

Proper design of exhaust hoods is necessary if a local exhaust system is to effectively control atmospheric contamination at its source with a minimum air flow and power consumption. The theory of capture velocity depends on the creation of air flow past the source of contaminant sufficient to remove the highly contaminated air around the source or issuing from that source and to draw the air into an exhaust hood.

It can be shown that dust particles in the small micron sizes, even if impelled at extremely high original velocities, travel a very short distance in air--a matter of a few inches at the most (References 7, 16). Thus the fine dust particles of health significance follow the air currents and are often referred to as "air-borne dust." The same considerations apply to mists and fumes. Vapors and gases, of course, mix intimately with air and follow the air currents.

Larger dust particles released at high velocities (example, the larger particles from grinding) do have an appreciable trajectory or "throw" in air. These larger particles cannot be captured unless directed into the hood. Scattering can also be prevented by properly placed barriers. It is desirable to collect this dust as well as the truly air-borne dust and thus utilize the exhaust ventilation to improve the housekeeping and maintenance situation in the plant.

Principles of Hood Design

Basically, hood design requires sufficient knowledge of a process or operation so the most effective hood or enclosure can be installed to provide minimum exhaust volumes for effective contaminant control. The more complete the enclosure, the more economical and effective the installation will be. Many designers consider hoods by mentally enclosing the operation completely, from there providing access and working openings as indicated. From this complete enclosure concept, familiar hood shapes like booths, side or canopy hoods with or without side shields are developed. All openings are kept to a minimum and located away from the natural path of the contaminant travel wherever possible. Inspection and maintenance openings are provided with doors wherever practicable.

Open hoods that do not enclose or confine the contaminant are recommended only as a last resort because exhaust volumes are large and control can be so easily upset by cross drafts in the area.

Canopy hoods are effective for the control of hot processes and for those operations which release sudden surges of hot gases and vapors. Canopies should not be used where men must work directly over the operation as in the case of plating tanks and cementing tables since the flow of air passes the worker's breathing zone and increases his exposure to toxic materials.

Exhaust duct takeoffs will be located, when possible, to be in the line of normal contaminant travel and will be arranged so desired distribution of exhaust air flow is attained. In the case of large shallow hoods, contaminant tends to concentrate in front of the duct opening. Satisfactory air distribution can be attained by using multiple takeoffs or by installing interior baffles or filter banks.

Use of Flanges

Wherever possible, flanges should be provided to eliminate air flow from ineffective zones where no contaminants exist. Increasing the hood effectiveness in this manner will usually reduce air requirements by 25% (See Figures 4-2, 4-3 and 4-4.) For most applications the flange width can be equal to the hood diameter or width but not exceed 6 in.

Once the hood design has been determined that exhaust volume requirements can be calculated. In most cases, volume can be calculated from the known open area of the hood and the selection of the capture velocity sufficient to prevent outward escapement. Where enclosure of the process is impossible, the system in front of the hood must be such that selected capture velocities will be maintained in the zone of operation, conveying the contaminant to the hood opening.

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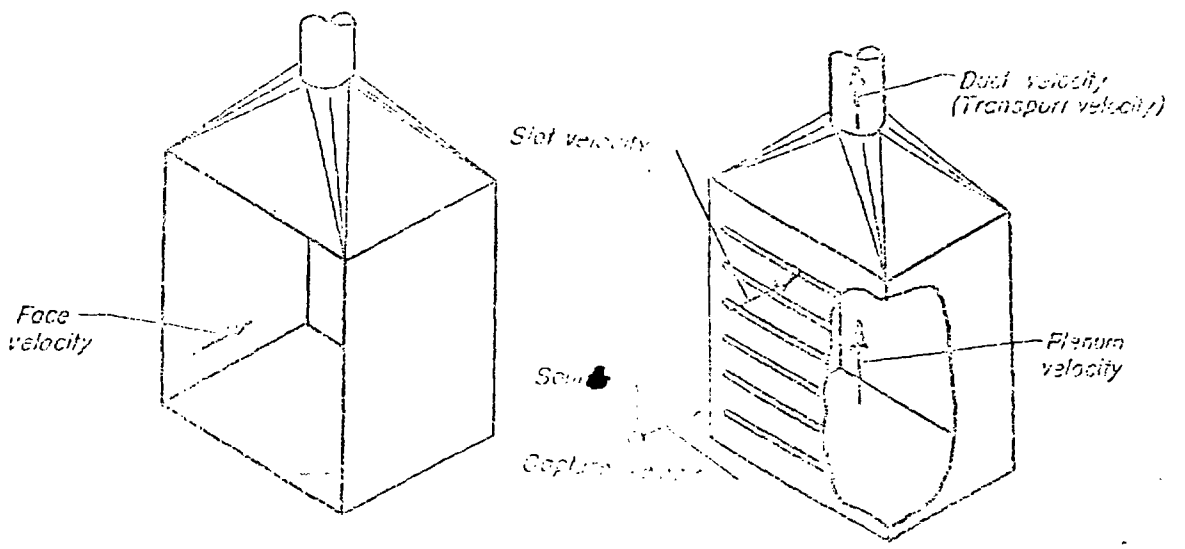

Capture Velocity — Air velocity at any point in front of the hood or at the hood opening necessary to overcome opposing air currents and to capture the contaminated air at that point by causing it to flow into the hood.

Face Velocity — Air velocity at the hood opening.

Slot Velocity — Air velocity through the narrow opening in a slot-type hood, fpm. It is used primarily as a means of obtaining uniform air distribution across the face of the hood.

Plenum Velocity — Air velocity in the plenum chamber. For good air distribution in slot-types of hoods, the maximum plenum velocity should be 1/2 of the slot velocity or less.

Duct Velocity — Air velocity through the duct cross section, fpm. When solid material is present in the air stream, the duct velocity must be equal to the minimum transport velocity.

Transport (Conveying) Velocity — Minimum air velocity required to move the particulates in the air stream, fpm.

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PRINCIPLES OF EXHAUST HOODS

DATE

Fig. 4-1

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Plain Openings

Air will move in all directions toward openings under suction. By definition, flow contours are lines of equal velocity in front of a hood. Similarly, streamlines are lines perpendicular to velocity contours. (The tangent to a streamline at any point indicates the direction of air flow at that point.) Figure 4-2 illustrates air flow in front of a circular opening.

The equation of flow before free hanging hoods (Reference 9) for round hoods, and rectangular hoods which are essentially square, is:

$$V = \frac{Q}{10X^2 + A}$$

Where:

V = Centerline velocity at X distance from hood, fpm
X = Distance outward along axis in ft. (Note: equation is accurate only for limited distance of X, where X is within 1-1/2 D)
Q = Air flow, cfm.
A = Area of hood opening in square feet.
D = Diameter of round hoods or side of essentially square hoods.

As can be seen from this equation and from Figure 4-2, there is a rapid velocity decrease with increasing distances from the hood, varying almost inversely with the square of the distance.

Where distances of X are greater than 1-1/2D, the velocity decreases less rapidly with distance than the above equation indicates (See References 36 and 54).

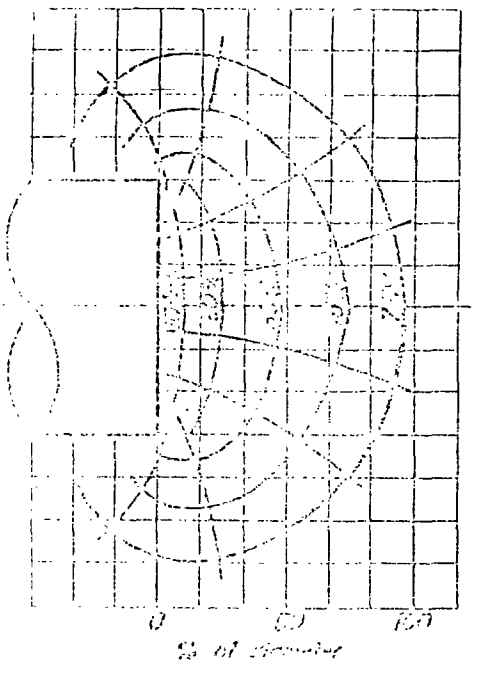

Fig. 4-2

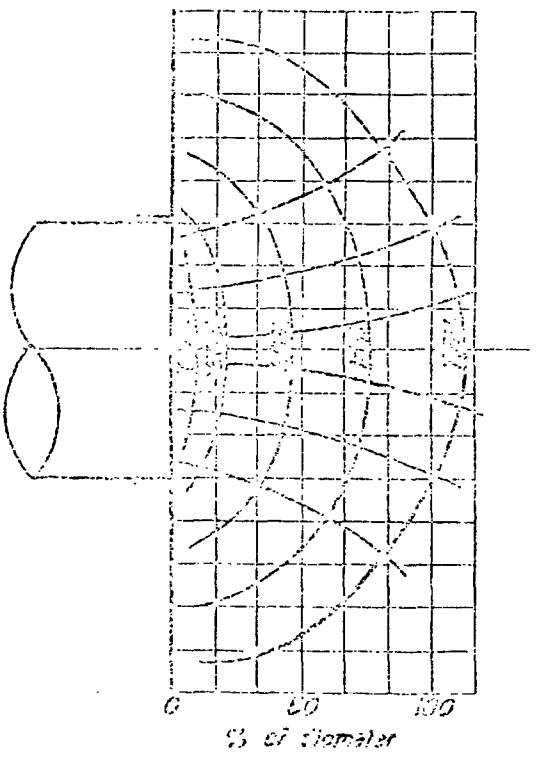

Fig. 4-3

Velocity contours (expressed in percentage of opening velocity) and streamlines for circular openings.

These velocity formulas apply to air flow conditions in front of freely suspended plain openings. Figure 4-4 shows other hood types and gives the air volume formulas which apply.

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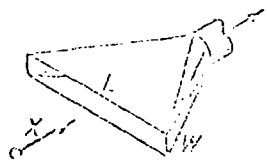
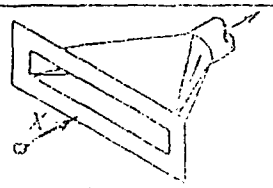
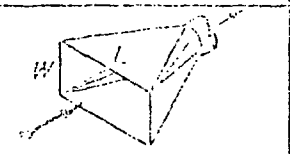
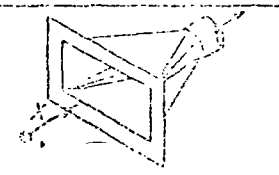
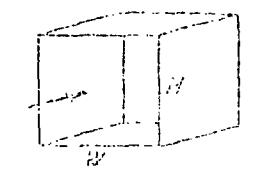
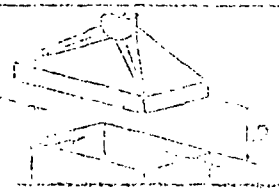
HOOD TYPE	DESCRIPTION	ASPECT RATIO, $\frac{W}{L}$	AIR VOLUME
	SLOT	0.2 or less	$Q = 3.7LVX$ (Reference 38)
	FLANGED SLOT	0.2 or less	$Q = 2.8LVX$ (Reference 38)
 $A = WL$ (sq. ft)	PLAIN OPENING	0.2 or greater and round	$Q = V(10X^2+A)$ (Reference 9)
	FLANGED OPENING	0.2 or greater and round	$Q = 0.75V(10X^2+A)$ (Reference 9)
	BOOTH	To suit work	$Q = V_f \times W \times H$
	CANOPY	To suit work	$Q = 1.4PDV$ See VS-603 P = perimeter of work D = height above work

Fig. 4-1

Capture Velocities

Capture velocity is the velocity at any point in front of the hood necessary to overcome opposing air currents and to capture the contaminated air by causing it to flow into the exhaust hood.

Exceptionally high volume hoods (example, large side-draft shakeout) require less air volume than would be indicated by the capture velocity values recommended for small hoods. This phenomenon is ascribed to:

1. The presence of a large air mass moving into the hood.
2. The fact that the contaminant is under the influence of the hood for a much longer time than is the case with small hoods.
3. The fact that the large air volume affords considerable dilution as described above.

Table 4-1 offers capture velocity data. Additional information is found in Section 5, Table 5-9-2.

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TABLE 4-1

RANGE OF CAPTURE VELOCITIES (7,24)

Condition of Dispersion of Contaminant	Examples	Capture Velocity, fpm
Released with practically no velocity into quiet air.	Evaporation from tanks; degreasing, etc.	50-100
Released at low velocity into moderately still air.	Spray booths; intermittent container filling; low speed conveyor transfers; welding; plating; pickling	100-200
Active generation into zone of rapid air motion	Spray painting in shallow booths; barrel filling; conveyor loading; crushers	200-500
Released at high initial velocity into zone of very rapid air motion.	Grinding; abrasive blasting, tumbling	500-2000

In each category above, a range of capture velocity is shown. The proper choice of values depends on several factors:

Lower End of Range	Upper End of Range
1. Room air currents minimal or favorable to capture.	1. Disturbing room air currents.
2. Contaminants of low toxicity or of nuisance value only.	2. Contaminants of high toxicity.
3. Intermittent, low production.	3. High production, heavy use.
4. Large hood—large air mass in motion.	4. Small hood—local control only.

Hood Design Procedure

Effective control of a contaminant producing process is brought about by first eliminating or minimizing all air motion about the process and then capturing the contaminated air by causing it to flow into the exhaust hood. Flow toward the suction opening must be sufficiently high to maintain the necessary capture velocity and to overcome opposing air currents.

Elimination of sources of air motion as a first step in hood design is an important factor in cutting down [illegible] volume and the corresponding power consumption. Important sources of air motion are:

1. Thermal air currents, especially from hot processes or heat-generating operations.
2. Motion of machinery, as by a grinding wheel, belt conveyor, etc.
3. Material motion, as in dumping or container filling.
4. Movements of the operator.
5. Room air currents (which are usually taken at 50 fpm minimum and may be much higher).
6. Cooling and heating equipment.

The shape of the hood, its size, location and rate of air flow are important design considerations.

The hood should enclose the operation as much as possible. If enclosure is not practicable, the hood should be [illegible] as possible to the source and shaped to control the area of contamination.

[illegible] be used whenever possible to eliminate exhausting air from ineffective areas (see page 4-1) [illegible] decrease the hood entry loss.

[illegible] Coefficient and Static Pressure

[illegible] suction air enters an opening, a typical flow pattern results as shown in Figure 4-2. Maximum [illegible] of the air stream occurs at a short distance downstream at the plane of the vena contracta where [illegible] the jet is smaller than the diameter of the duct.

The [illegible] of the vena contracta is accompanied by a conversion of static pressure to velocity pressure [illegible] pressure back to static pressure. A loss of about 2% in static pressure results from the [illegible] to velocity pressure and a much greater loss in static pressure results from the conver[illegible] velocity pressure at the vena contracta to static pressure as the air fills the duct. The area of the [illegible] the vena contracta will vary with the shape of the hood or duct opening and for most hood shapes [illegible] 70% to 100% of the duct area.

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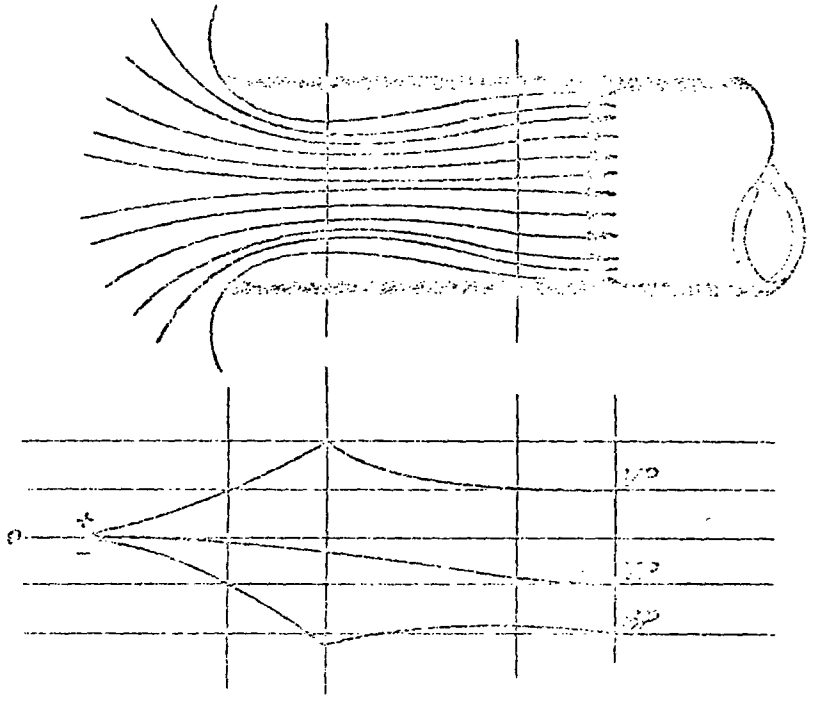


Fig. 4-5. Air flow at the vena contracta.

The losses due to pressure conversion result in a decreased rate of flow as indicated by the coefficient of entry, C_e. The coefficient of entry is defined as the actual rate of flow caused by a given static pressure compared to the theoretical flow which would result if the static pressure could be converted to velocity pressure with 100% efficiency. It is the ratio of actual to theoretical flow. Figure 4-8 provides C_e values for many hood types.

Coefficient of entry C_e represents the percentage of flow that will occur into a given hood based on the SP developed in the branch. CFM for any hood can be written either in the usual ($4005 A \sqrt{VP}$) or as ($4005 A C_e \sqrt{SP_h}$)

$$Q = 4005\ A \sqrt{VP} = 4005\ A\ C_e \sqrt{SP_h}$$

$$C_e = \sqrt{\frac{VP}{SP_h}}$$

Hood entry loss h_e is another convenient means of determining air flow through a hood and can be defined as the pressure loss in pressure caused by air flowing into a duct.

SP_h at hood = VP in the duct + h_e. Relationship between C_e and h_e can be derived as follows:

$$C_e = \sqrt{\frac{VP}{SP_h}}$$

Substitute $SP_h = VP + h_e$

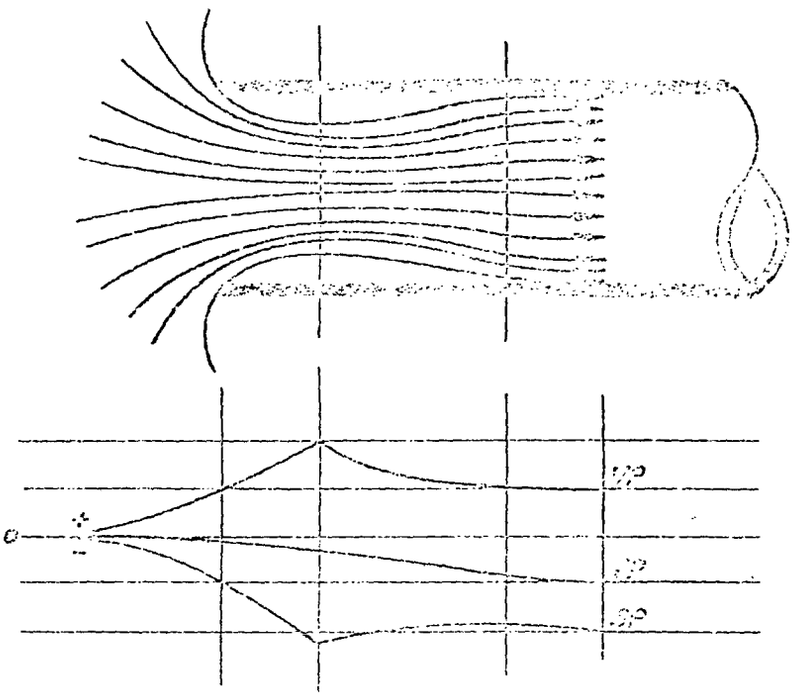
$$C_e = \sqrt{\frac{VP}{VP + h_e}}$$

$$C_e^2 = \frac{VP}{VP + h_e}$$

$$h_e = \frac{VP}{C_e^2} - VP$$

$$= \frac{(1 - C_e^2)}{(C_e^2)}\ VP$$

CAPCO KIN 0000480



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to other parts of the plant except upon Company business.

4. Do not ride on any burden being carried by a crane.

5. No one is allowed to operate any machinery, unless duly authorized by the proper authority.

6. All gears, sprockets, saws, belts, etc., and all projections on revolving shafts, such as set screws, keys, couplings, bolts, oil cups, etc., shall be properly guarded. Any employee removing any guard or safety device from any mechanical equipment for any reason shall see that such guard or safety device is replaced, before the machine is put in operation.

7. Never work on any electrically driven machinery until the control switch has first been locked in the off position and the operator notified.

8. Do not turn on any electricity, gas, steam, air or water, or set in motion any machinery, or throw down any material without first seeing if any one is in position to be injured.

9. All persons not authorized by the Electrician are forbidden to work upon any electrical apparatus. You are warned against touching wires of any kind, as it may result in death. Before doing any work where there is danger of coming in contact with electric wires, notify the Electrician, who will advise concerning the work. Do not try to fix electric lights, but call your foreman or electrician.

10. Hand tools must be kept in good condition, mushroomed heads, or other dangerous conditions of drills, hammers, cutters, and other tools will not be permitted.

11. All work must be done in a neat and orderly manner. No repair or construction job will be considered complete until all refuse and excess material has been stored in its proper place.

12. No employee shall bring upon the plant property, or in or around any building thereon, any dangerous weapons, intoxicating liquor, or possession of illegal goods of any kind.

13. Injuries, including those of a minor nature, must be reported to your foreman before the shift is completed.

14. Wrestling, throwing of material, or "horseplay" of any kind, is positively prohibited. Fighting in, or around the plant property and buildings thereon is strictly prohibited.

15. Be ever watchful of loads carried by cranes or suspended in the air, and keep out from under them.

16. Removing or replacing electric light bulb or socket with the current on is prohibited.

17. Do not play with compressed air, never blow the air on anyone. It may enter the body and injure or cause death. The working on air lines while the pressure is on is prohibited.

18. It shall be a violation of the rules to sleep while on duty in or about the plant.

19. Goggles shall be worn when grinding, cutting, welding, or striking where particles may fly, including employees exposed to possible eye injury as a result of work being performed by other employes.

20. Oiling, greasing of machinery, or cleaning of belts or conveyors while in motion is not permitted, except where protection is provided against moving parts.

21. Loose clothing must not be worn by employees who are required to work around moving machinery.

22. Empty soft drink bottles must be placed in racks provided. Lunch papers, paper cups, etc., must be placed in trash cans.

23. When products are being loaded or unloaded from railway cars, workmen shall see to it that car brakes are properly setup and car or cars well secured to prevent movement.

24. Respirators and goggles must be worn by each

CAPCO KIN 0000582

employee when the particular circumstances make either of them needed.

25. Additional protective apparel or equipment required for the personal protection of any employee exposed to a special hazard by reason of a special occupation or work shall be worn or used by the employee subjected to such hazard.

26. Oil and grease kept in the plant shall be in substantial covered metal containers.

27. Employees shall use care in placing ladders before using them. If there is danger of the ladder slipping, have someone hold it. Do not use an unsafe or make-shift ladder.

28. Do not go up or down a ladder without the free use of both hands. If material is to be handled, use a rope. Do not reach more than an arms length from ladder.

29. All scaffolds, whether swinging or otherwise, when higher than six (6) feet above the ground shall be provided with railings of substantial strength. Floor boards of scaffold must be fastened to prevent slipping.

30. Employees removing the cover from any opening in the floor, ground, valve pit, or sewer, must take steps to guard that opening so no one will fall into it.

31. Any employee reporting to work under the influence of intoxicating liquor will be discharged.

32. Employees performing work under elevated equipment or machinery, etc., must have the same securely blocked in addition to lifting jacks, hydraulic systems, chain blocks, etc.

33. Employees are forbidden to run on the job except to protect himself or others from personal injury.

34. Riding on the running boards or on the outside of fork trucks is prohibited.

35. Employees shall use a brush to clean metal shavings from drill presses and lathes and the cement asbestos shavings from machines and machine tools.

36. Supplies and material should be stored in bins and racks in such a manner that it will not obstruct aisleways.

37. Storing of supplies and material in walkways, aisleways, and on stairs is prohibited.

38. Work benches and the front of work benches shall be kept free of excess material and oils.

39. When there is any doubt as to the best and safest method of doing work, and when instructions are not complete or thoroughly understood, the foreman must be consulted and his direction followed.

LATHE OPERATORS

A lathe is not an especially dangerous machine, but it must be intelligently operated if accidents are to be prevented.

1. Wear eye protection, guard against flying chips.
2. Do not hand brake the machine.
3. Do not caliper or gauge the job while machine is in motion.
4. Do not leave chuck wrench in chuck.
5. Do not wear loose clothing.
6. Do not leave machine running unattended.
7. Use a hooked rod for handling chips.
8. Use file with protected tang.
9. Use stick to hold emery cloth against work.
10. Keep the work area clean around the machine.

GRINDING WHEELS

1. When grinding, eye protection must be used in addition to eye shield mounted on grinder.
2. Work rest must be adjusted to within ⅛" of wheel.
3. Do not grind on side of wheel.
4. Do not use gloves when grinding small work.
5. Report grinder defects to your foreman.

CAPCO KIN 0000583

DRILL PRESS

1. Be sure the work is securely clamped.
2. Wear eye protection if work is throwing off chips.
3. Do not wear loose clothing that could be caught in revolving parts.
4. Keep the work area clean and clear of stumbling hazards.
5. Do not leave machine running unattended.
6. Report any machine defects to your foreman.

TOOLS

Because of the widespread use of hand and power tools and the severity of many tool injuries, it is important that control of tool accidents be made a part of every safety program.

1. Workmen are expected to select the right tool for the job.
2. Tools must be kept in good condition.
3. Tools must be used in the right way.
4. Tools must be kept in a safe place.
5. Do not use a wrench for a hammer, pliers for a wrench.
6. Do not use tools with split or broken handles or mushroomed chisels.
7. Do not carry tools or lay tools down where they may fall on someone.
8. Report defective tools to your foreman.

ELECTRIC WELDING

1. Be sure the work setup is such that the work is grounded. Exercise care or the welder or operator can easily become grounded.
2. Do not dip hot electrodes in water.
3. Never change electrodes with bare hands or wet gloves, or when standing on wet floors or grounded surfaces.

4. Report any defects in the welding equipment to your foreman.
5. Welding cables and cutting hose must be neatly stored with machines when not in use.

BURNING AND CUTTING

1. Shut off gas at the pressure-reducing regulators before changing torches, do not crimp hose.
2. If welding or cutting is stopped for sometime (lunch or overnight) close oxygen and acetylene cylinder valves, then open torch valves to relieve gas pressure from hose and regulator.
3. Do not use matches to light torches.
4. Point torch away from others when lighting.
5. Never put torch down until the gases have been completely shut off.
6. Do not hang lighted torch over regulators.
7. When burning or cutting in an area containing combustible or flammable material, fire extinguishers or their equivalent must be readily available.
8. Keep hose wound around regulators or cart when not in use. Protect hose when in use from falling sparks.

OXYGEN AND ACETYLENE

1. Oxygen and acetylene cylinders should be kept in an upright position and secured against accidently being knocked over. Empties must be returned to storage area and replaced with full one.
2. Never use oil or grease as a lubricant on valves or attachments of oxygen cylinders. Keep oxygen cylinders and fittings away from oil and grease, and do not handle such cylinders or apparatus with oily hands, gloves, or clothing.
3. Never use oxygen as a substitute for compressed air in pneumatic tools, in oil preheated burners, to start internal combustion engines, or to blow

CAPCO KIN 0000584

out fuel lines. Oxygen under presseure will explode when in contact with oils or grease.

POWER TRUCKS AND FORK LIFTS

1. Operators must give proper signal when turning.
2. Slow down at intersections and doorways.
3. Look in direction of travel and obey all signs.
4. Do not travel with load too high.
5. Report defective equipment to your foreman.
6. Do not ride on fork trucks. No one but the operator is permitted to ride.
7. Do not run over loose material on floor such as cables, hose, boards, and other obstacles.

We believe we should all be proud of our plant, and we think most of us are. The management wants the plant kept neat and clean and orderly, as attractive and comfortable a place to work in as possible.

Management cannot do the entire job. Unless we all help, we're up against a tough proposition. Sure, the other fellow can do his best, but if we fail to do our part, the job will not be done.

Let's each one of us keep our own job in order, thus maintaining a clean safe plant and safeguarding our future.

No._____

I hereby acknowledge receipt of a copy of the Cement Asbestos Products Company Safety Rules for CAPCO Plant.

As a condition of my employment, I agree to study and learn these rules and to abide by all of them. To be careful to protect myself and fellow workmen from injury.

Name _____

Badge No_____

Occupation _____

Witness _____

Date_____, 19____

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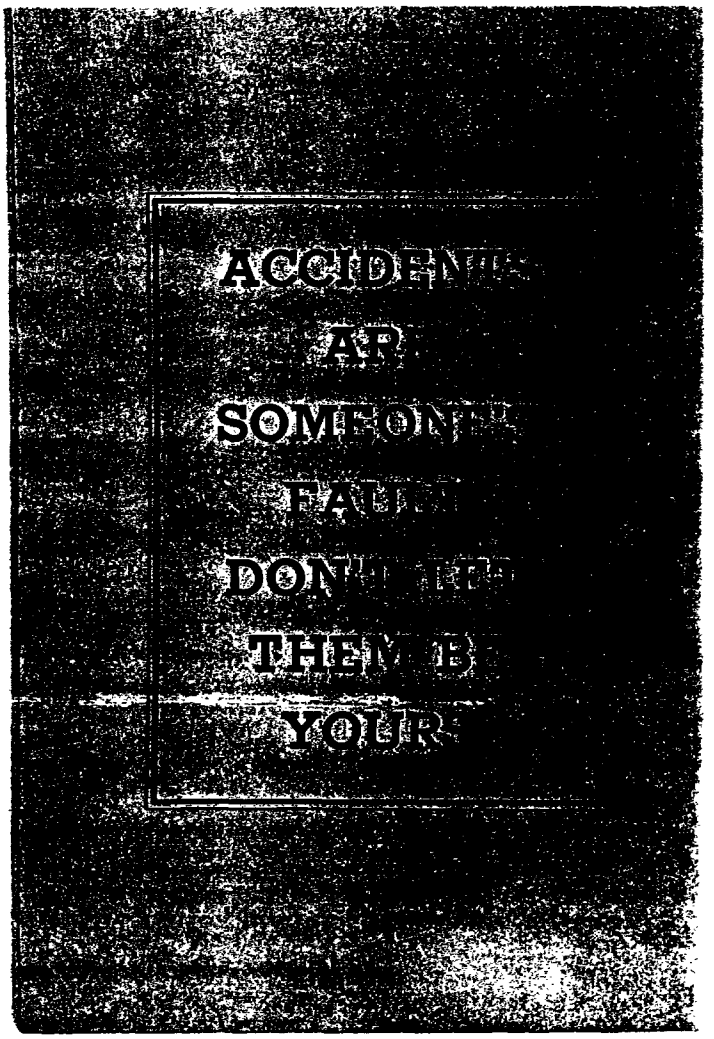
ACCIDENTS
AR
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YOUR