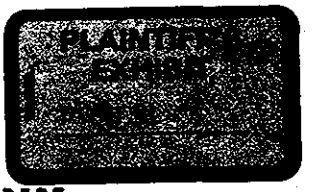
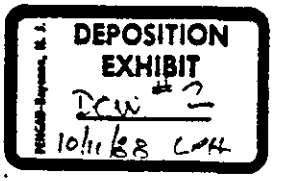


DOW THE DOW CHEMICAL COMPANY

MIDLAND DIVISION
July 30, 1969

INTRODUCTORY & SUMMARY REMARKS - M. T. Badley



Introduction:

Many of you gentlemen have waited some time for this get-to-gether. I'm sure the following presentations by Dr. Ducommun, from our Medical Dept., Roy DeGesero, from Environmental Research, Roy Anderson, from Organic Chemicals Mtnce. and Larry Warren, now Supt. of Construction in CCP, will be of vital interest to you.

ST0000284

There are several reasons for this interest on your part - mainly however, a request by the coverers on "How Does the Handling of Asbestos Content Insulation Affect Me?" Other interests certainly will be, "What are the Solutions?" and "How Should We Implement the Solutions?" Solutions to a problem sometimes cause other problems -- a couple in which the production people here have a stake, such as technology and costs. This, obviously, is a matter of concern to them.

These fellows, that I named before, are going to present the problem to you -- the solutions, with time for questions.

I'm sure you -- especially the coverers -- will be listening carefully. I'm hopeful that by the end of these presentations and the Question & Answer Period, all of your questions will be answered.

Mr. Roy Degesero - Environmental

I would now like to introduce ~~DR. DUCOMMUN~~ from our ~~Medical~~ Dept. Research. Roy -

Mr. Degesero & Dr. Ducommun have presented the technical aspects to us with several recommendations - you might now be asking yourselves "NOW WHAT DO WE DO?"
LARRY WARREN will now discuss PERSONAL PROTECTION with us.

SUMMARY:

1/2 Hour

As you can see, the past ~~35 minutes~~ presentation, ~~questions and answers~~, affects ALL of us. Those of us in management have a moral and legal obligation to see that you have a safe environment in which to work. To continue our efforts to give you a safe place to work -- we are obviously going to eliminate any insulating material containing asbestos * TRANSPARK ASAP. Starting August 11, in specific areas, until adequate substitutions are acquired, approved respiratory equipment must be worn.

Thank you for your attention. INTRO. DR. KRAMER

We will now attempt to answer any question you might have at this time.

ST0000285

RECOMMENDATIONS

1. USE LOCAL VENTILATION

2. USE APPROVED RESPIRATORY PROTECTION

3. REPLACE INSULATING MATERIALS CONTAINING ASBESTOS

SUMMARY

1. WE HAVE A KNOWN HEALTH PROBLEM.

2. THE SOLUTIONS MAY NOT BE POPULAR.

3. WE HAVE A CHOICE BETWEEN PROTECTING EMPLOYEE HEALTH - OR - OCCASIONAL DISCOMFORT.

WE ARE GOING TO PROTECT YOUR HEALTH!

Good day, Gentlemen. My name is Roy DeGesero. Supervision requested an environmental study of Midland pipe coverers' exposures to dusts from insulating materials used here in Midland. These dusts contained asbestos and fiberglas. I shall present the results of the study, conducted from January to April, 1969, then turn the meeting over to members of Medical and management.

Before discussing what the exposures are, I'd like to define a term you'll hear several times today. That term is "time-weighting." "Time-weighting" means that we looked at what you do, and how often you do it, and how much of a certain dust you fellows are exposed to at these times.

We learned how often and how long pipe coverers perform the several most common jobs of pipe covering by talking to you men, your supervision, looking at the time study and from personal observations. We decided on this basis where to sample the air containing dusts caused by pipe covering. The sampling gave us a concentration number of millions of particles of dust per cubic foot -- an expression of how much dust is in the air you men breathe.

(SHOW SLIDE I)

This table is a list of the most common operations pipe coverer's perform: removing old covers, mixing adhesives and so forth. Next to the operations are the % Day or estimated average time spent by a pipe coverer performing these operations. Then next to that are the mean concentrations in mppcf measured for each operation with each material listed, and the range of concentrations. Finally, we see a column with the fractional products of time x concentration, for each material in each operation. When this column of fractions is totaled, we have arrived at a time-weighted exposure, and can then discuss the significance of this number. For men working indoors, the time-weighted average exposure to asbestos containing dusts was 4.9 mppcf in the 8-hour day. The time-weighted exposure to fiberglas (dust) was 0.5 mppcf.

(SHOW SLIDE II)

This table represents the time-weighted exposures to asbestos containing dusts for men working outdoors. That number is 4.2 mppcf and reflects the fact that some air movement outdoors tends to dilute the dust. The time-weighted exposure to fiberglas dust was 0.4 mppcf.

After obtaining a time-weighted exposure, we then relate this exposure number to the best current information available on the health experience with asbestos and fiberglas. A group of advisors called the American Conference of Governmental Industrial Hygienists has gathered up as much sound data as is available from laboratory research and field experience on the health problems associated with insulating materials, and the ACGIH expresses this information in numbers called the Threshold Limit Values; asbestos has one TLV, and fiberglas has another, different TLV.

The Threshold Limit Value describes a TWA average concentration of dust to which men can be repeatedly exposed for 8 hours with no adverse effect on health. This average number can be exceeded for brief periods of time, provided such excesses are balanced by equally long periods of time when exposures are below the average Threshold Limit Value. For asbestos, the present TLV is 5 million ppcf, based on knowledge accumulated 30 years ago. Present experience with health problems in

insulators and others working with asbestos has suggested that the Threshold Limit Value be lowered by 1971 from 5 mppcf to 2 mppcf, in light of very subtle health problems.

The TLV number represents good practice and is used by most governmental agencies in maintaining healthy work environments. As you can see, the time-weighted exposures we have measured for asbestos containing dusts are above this proposed TLV of 2 mppcf. The time-weighted exposures for fiberglas containing dusts are below the TLV for fiberglas dusts. That TLV is 15 mppcf.

The Environmental Research Laboratory has proposed to management, three ways of lowering pipe coverer's exposures to asbestos containing dusts to within the 1971 limit. They are:

(1) Use local ventilation (on the job air movers) to pull dusts away from the man's breathing zone, or

(2) Use approved respiratory protection whenever men remove, cut, or apply, Aircell, Kaylo, High-Temp ~~or Thermobestos~~, or when they mix Webers and Armentite.

(3) Replace present insulating materials containing asbestos with materials which do not present the health problems of currently used materials containing asbestos.

Warren Portion of the Insulation Talks

After all of the explanation and facts concerning the hazards of asbestos I can imagine a lot of you are wondering "where do we go from here?"

For years and years, asbestos and insulation value have been almost synonymous. The higher the asbestos content the easier it was to sell. Most of us were aware of the health problem, covering asbestos, but it seemed rather insignificant as it didn't seem to be affecting us much.

Then there were a couple articles in our local paper concerning the affects of asbestos on the respiratory system. These were brought to my attention and I in turn brought it to the attention of the Medical Department & Invirpmental Research.

We decided that each of the coverers should have a chest x-ray and at the same time we should have an invironental research study to find out exactly what our exposure is.

We were very pleased to find that none of our coverers had asbestosis. But when the invironental research findings were told to us we recognized that we do have the potential for

The Doctor and Roy Degesro have explained the causes of the problem and the affect on the body. I'm here to tell you we expect to eliminate the problem. If you will remember Roy gave us three (3) things he thought we could do that would lower the parts per million of asbestos dust to a acceptable level.

1. Local ventialtion. You and I know this is not an acceptable method as it would be [redacted]

2. Use Bureau of Mines approved respiratory protection (show example). This is an acceptable method in most cases if we follow the chart I will now show on the screen. If you will notice the removing of aircell, Kaylo, high temp. and mag oxide have all been checked. All of you men who are in the trade I'm sure have seen the reason for this. Also checked is the applying of Kaylo and aircell. It was found the applying of either of these insulations caused the parts per million of dust in the breating area to to to 5.7 which is above the limit. This was almost 35% of your work day. The mixing of asbestos shorts or plus one is also checked for appar nt reasons.

You will notice that Fibriglas is not checked in any catagory. The reason for this has been pretty well covered by Roy & Dr. Ducommon. I will only say that I've heard

many controversal words said about fibriglas, but never have I heard or read any thing by a reliable source, that said it was dedtrimental to your health. In fact I have with me a pamplet put out by the Industrial Hygiene Foundation of America from which I would like to read you a few excerpts.

I would say that under same circumstances that it is some what uncomfortable. According to most people who have studied its use, a person using Fibriglas insulation should wear loose fitting clothing, no tight belts or cuffs and they should keep clean.

Talking about cleanliness brings up another point that bears mentioning and that is that shower time for men using fibriglas is <u>not</u> and I repeat not, automatic or mandatory for health reasons. A supervisor will grant shower time if he feels the condtions warrent it.

3. Keplace our present asbestos containing insulation with materials that don't cause a health problem. We have all of our resources on the lookout for replacements now. Ray Anderson will cover this subject further later on.

These were Roys recommendations and starting August

a) [redacted] as much as possible with non asbestos [redacted] Finbrglas foam glas, cermic foam, polyurethane, etc.

b) When using insulation containing asbestos, [redacted] a bureau of mines approved [redacted] as per the chart. We will pass out a wallet size copy of the chart as you leave.

c) [redacted] for mo[redacted]

If we do these three things there is no doubt in my mind that we will be below the 2 N.P.P.C.F. limit that will go into affect soon.

Gentlemen, we have a problem; it isn't going away by itself. We feel we recognize the problem and we have the solution. You have heard the plans. We expect and insist that we get your full cooperation to implement these plans.

I'm sure some of you men are sitting there thinking about possible additional costs, and of the possible corrosion in some instances where a perfect weather barrier is not achieved. We know we have had some of these problems in

By working together we know that all the problems can be worked out. Our main objective today is to make the job safe for you men. The economics are important, but not of prime importance at this particular time.

Thank you for your attention, now here is Roy Anderson to talk about possible substitutes.

Remember August 11th is the day that we must wear respiratory protection when working with asbestos type insulation. The card is your guide.

Thanks again

Here's Roy.

THE DOW CHEMICAL COMPANY

July 17, 1969

As a result of his survey, Mr. DeGesero has made up a table showing under what conditions and with what materials an approved respirator must be worn. This table has been reproduced on a small card and each one of you will receive a copy. (Show transparency on the screen.)

I think you all know that there is a very good replacement for Aircell and that is Fiberglas. Fiberglas is more than twice as effective as Aircell as an insulating material and contains no asbestos. (K factor .61 versus .29) Fiberglas is being used in every Dow division except here at Midland. Actually, Aircell should not be used on any job except for personnel protection. It is not designed for temperatures higher than 200° F. and we know it is commonly used on lines traced with 150# steam (375°F.)

At the present time we are trying out an expanded silicone (perlite) type of insulation called Careytemp 1500. This material does contain about 6% asbestos which is about the same as Kaylo; however, it is not supposed to be nearly as dusty. The Phillip-Carey Company has been doing some work on eliminating completely the asbestos from this material. More information on this material will be forthcoming as soon as an evaluation can be made.

Hi-temp is a diatomaceous earth type of insulation which contains about 15% asbestos. There is no non-asbestos substitute for this material on very high temperature applications; however, its use is rather limited and it should not present a real problem.

Mag Oxide is another fairly high asbestos containing insulation which, at present, is not being used to any great extent here in the plant.

Mineral wool insulating cement commonly known as Webber's Cement contains about 10% asbestos and is quite dusty when being mixed with water. It has been suggested that the dry material be made up in batches large enough to last for a week or two. This would eliminate the need for a respirator each time the material is used. The use of Armentite is small enough so that making up large batches would not be warranted except in special cases.

Every major manuracturer of insulation has been contacted with regard to new products available, etc. This practice will be continued and any time we can find a new product that will be more effective or easier to work with, it will be brought into the plant for your use.

Roy Anderson
Maintenance Engineer
222 Building
Phone 6-4456

rb

MINIMAL RESPIRATORY PROTECTION REQUIREMENTS

Material	Remove	Mix	Cut	Apply
Air Cell	X			X
Kaylo (Cal sil)	X		X	X
High Temp.	X			
Mag Oxide	X			
No. 1 Plus (Webbers)		X		
Armentite (Asbestos Shorts 352)		X		
Super Power				
Thermobestos				
Fiberglass				

1. You [redacted] wear a respirator* when doing the above operations marked "X"

2. You [redacted] respirator* [redacted]

*MSA Dustfoe or Sure Guard (R-2090) are the only allowed types.

ST0000300

7-24-69

Jack:

This is the cost information that Larry, Roy, and I put together this morning for Jim Scovic. He seemed pleased with it and is sending copies to the Productivity Committee.

See you Monday.

Tom

ST0000301

THE DOW CHEMICAL COMPANY

MIDLAND DIVISION
July 28, 1969

JMB Please copy for MT Bixley also attach to my copy of insulation writeup

→J. M. Scovic

cc: R. G. Carlson
D. D. DeLine
A. C. Wilcox

INSULATION MATERIALS

The Productivity Committee has reviewed your letter of July 24 with the attachments that outlined some of the economic considerations comparing Aircell asbestos insulation with Fiberglas.

It is clear that we have not only a significant safety advantage with Fiberglas but an economic advantage as well. We strongly support your pursuing the necessary communication program within the Maintenance organization that you suggest and taking positive action steps to discontinue the use, wherever possible, of asbestos insulation.

W. H. Fletcher

W. H. Fletcher
For the Productivity Committee

dmf

file

ST0000302

DOW 00098

THE DOW CHEMICAL COMPANY

MIDLAND
July 24, 1969

J. M. Scovic
Manager of Services
47 Building

INSULATION HAZARDS AND MATERIAL REVIEW
(ECONOMIC PHASE)

The prime objective in developing our program on insulation hazards and materials has been to correct a potential safety hazard we may have.

Attached you will find an economic analysis. This analysis is in much greater depth than we intend to present in our communications program as part of the formal agenda. This economic information has been gathered mainly for background information and will be used to answer economic questions which I am sure will arise. I might at this point say a few words about the attached exhibits.

Exhibit I is a letter written by Roy Anderson which is intended to be mailed out to the production representatives after they have attended our communications meeting. The objective of this letter is to reinforce our opinions on the merits of the various insulation materials.

Exhibit II is a simplified, straightforward, hypothetical cost comparison.

Exhibit III is the backup data used to develop the figures in Exhibit II. We have a factor in the economics of comparing insulating materials which we have previously not examined closely which is the thermal conductivity coefficient. The k factor for Aircell is .61 while the k factor for Fiberglas is .29. Over the years Aircell insulation has been grossly misapplied. The top temperature limit for Aircell is 200°F. In order to have a working system we have found that additional steps have been taken to make up for this thermal conductivity coefficient deficiency. One that is commonly used is the wrapping of the pipe and tracer with aluminum foil prior to installing the Aircell. A second method which is commonly used is applying Thermon heat transfer cement on the tracer to more evenly distribute the heat. By using the proper insulation such as Fiberglas, the need for these extra steps could be eliminated. The cost of these extra steps certainly must be taken into consideration when comparing Fiberglas and Aircell insulation.

Exhibit IV simply states the volume of Aircell insulation used. The latest figures available are for the year 1967. However, the insulation material costs are the current costs. It is undetermined at this time whether an increase in the volume of purchase of fiberglas would qualify Dow for a lower per unit cost.

Exhibit V, which is an analysis by Roy Anderson, states the steam cost penalty we pay for under insulating when Aircell insulation is used without a backup of either aluminum foil or thermon.

Our estimates do not include the additional cost of the safety precautions we will have to take to protect our people against the asbestos hazards connected with Aircell. We estimate an additional 20 minutes per day will be diverted away from the productive portion of a job into the safety portion of a job due to the use of respirators. This amounts to an additional cost of roughly $58,000 on an annual basis. The purchase of the respirators themselves and the replacement cartridges will add another $4,000 annually.

Shower time will not be automatic when insulators install Fiberglas. The Foreman on the job will use his discretion with the insulators as he does with the other craftsmen as to when shower time should be recommended. I am sure that the cost of shower time will diminish as Fiberglas becomes a more accepted insulation material.

Following is a combination of the data shown in Exhibits II and V reflecting the most extreme conditions. The example was to insulate 200 feet of traced pipe:

Fiberglas insulated	$506
Aircell insulated	$442
One shot savings on insulation costs	$ 54
Steam cost increased $23 per year	
Return on investment 42.6%	

I believe first and foremost from a safety standpoint that it is imperative that we change our insulation practices. I believe from an economic standpoint the overwhelming use of Fiberglas insulation throughout the country would certainly indicate an economic benefit will be gained from using it.

I would like at this point to express my appreciation for the assistance that Larry Warren and Roy Anderson gave in developing the attached data. I think these are two professionals that we can truly be proud to have within our organization.

ST0000304

DOW 00100

Please feel free to contact me on any further questions you may have.

T. J. Madden
Maintenance Manager
Agricultural Chemicals Production
Organic Chemicals Production
222 Building
Phone 6-2225

TJM:rb

Enc.

INSULATION

ECONOMIC ANALYSIS

AIRCELL VS. FIBERGLAS

EXHIBIT I	Roy Anderson's letter to Plant Supervision on insulation alternates and applications
EXHIBIT II	Summary of comparative insulation costs on a hypothetical job
EXHIBIT III	Detailed labor and material cost comparisons
EXHIBIT IV	Aircell insulation usage and material costs of Aircell vs. Fiberglas
EXHIBIT V	Theoretical heat loss comparison between Aircell and Fiberglas insulation

THE DOW CHEMICAL COMPANY

MIDLAND
July 24, 1969

INSULATING MATERIALS AND ALTERNATES

We are principally concerned in this discussion with materials which may be substituted for some of our existing asbestos-containing insulation and how this will affect us economically.

The use of Aircell pipe insulation should be eliminated from the plant. It should never be used in any application over 200°F. and then for personnel protection only. It has a K factor of .61 as compared to .29 for Fiberglas. Fiberglas is about 25% more expensive to purchase; however, if aluminum foil is used with Aircell, as is the case many times, it is questionable whether one is more expensive than the other. (See table of estimated costs attached.) Temperature wise, Fiberglas is recommended up to 400°F. It is available either plain or with a number of factory applied jackets, some of which are self-sealing. Ordinarily, we would cover the plain Fiberglas insulation with the same JM paper that is now used over Aircell. It is necessary to wire the paper onto Fiberglas inasmuch as staples will not hold. This procedure makes the process slightly more time consuming than with staples.

A completely dry piping system can be made up by using wedges of Fiberglas blanket for ells and fittings and covering these with preformed fittings of PVC. A waterproof tape can be used to seal the joints.

In the temperature range of 400° to 1200°F., calcium-silicate is still the standard insulating material. As a substitute, we are presently making a survey of Careytemp 1500. This is an expanded silicon (perlite) material with a temperature range up to 1500°F. It does not absorb water and has a very low chloride content. At the present time it contains about 6% asbestos; however, in the near future it may be available in an asbestos-free form. The K factor is almost identical to calcium-silicate.

Another alternate material for temperatures up to 800°F. is cellular glass. This material is more expensive than calcium-silicate and should be used only where its special properties merit the extra cost. It is more dense than calcium-silicate and non-absorbent. This property makes it especially valuable where there is danger of autoignition. It is ideal for dual temperature vessels or pipelines. The material is easily worn away by abrasion and for this reason tank heads should be adequately protected. Glass cloth imbedded in epoxy resin is excellent for this purpose.

The material is available in preformed sections for both pipes and tanks. The K factor is very similar to calcium-silicate. The Dow Chemical Company has only recently entered this field with a material called Ceramic Foam.

If you have any questions or want further information on insulation, please feel free to contact me.

Roy Anderson
Maintenance Engineer
ACP & OCP Maintenance
222 Building
Phone 6-4456

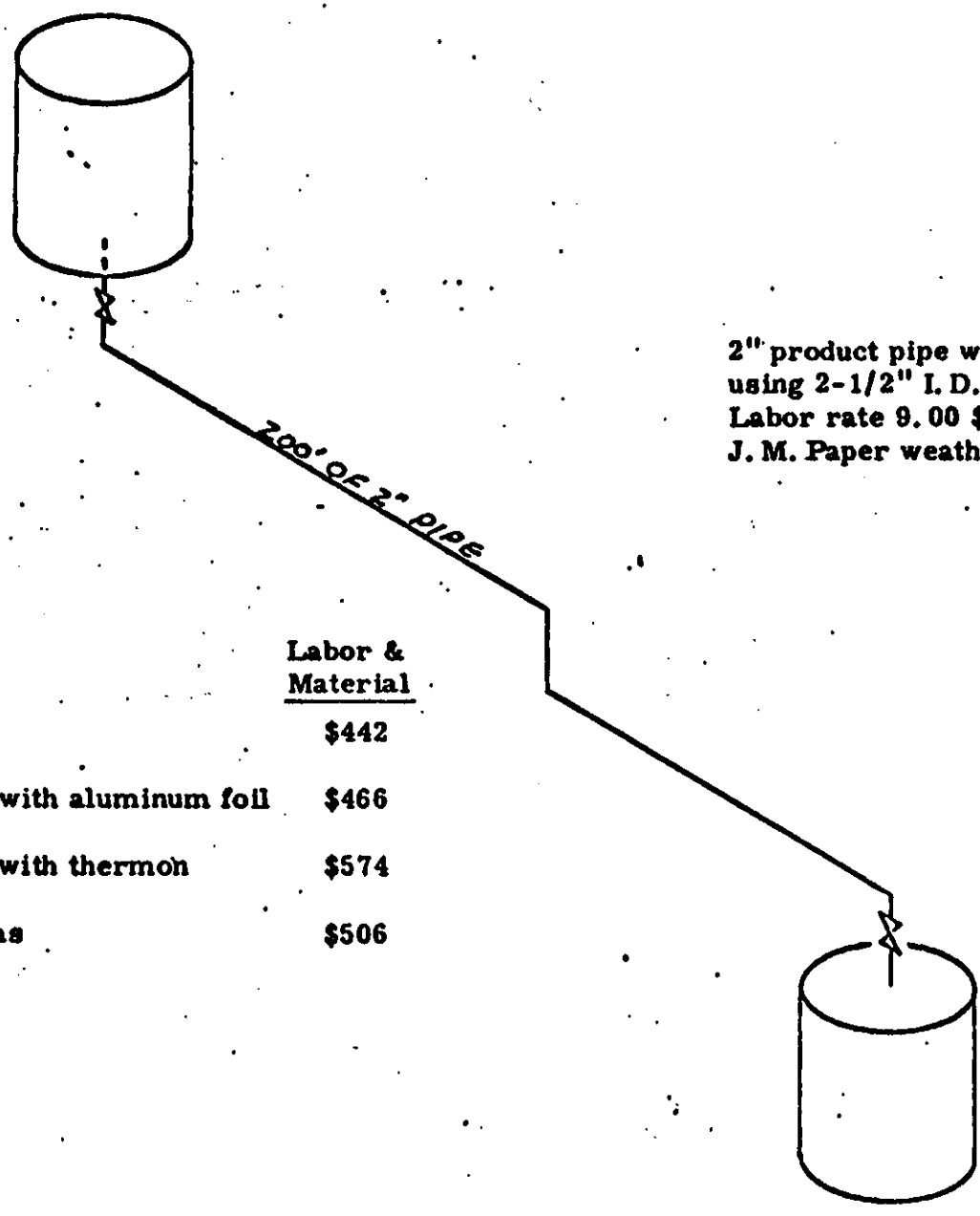
rb

EXHIBIT II

HYPOTHETICAL COVERING JOB

ST0000309

DOW 00105



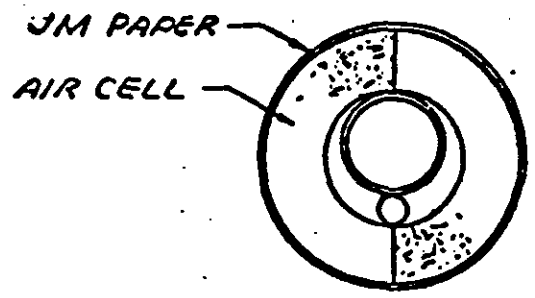
2" product pipe with steam tracing
using 2-1/2" I. D. insulation.
Labor rate 9.00 $/hr.
J. M. Paper weather proofing

	Labor & Material
Aircell	$442
Aircell with aluminum foil	$466
Aircell with thermon	$574
Fiberglas	$506

INSULATING A 2" PIPE SYSTEM PER FOOT

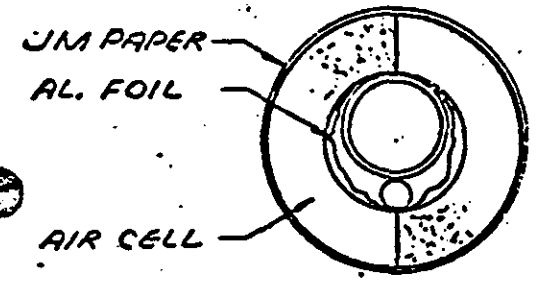
EXHIBIT III

AIRCELL



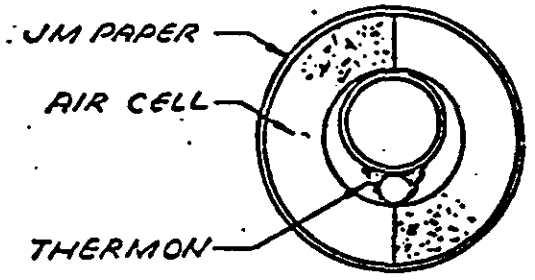
Material:	(Aircell	$ .29 per ft.
	(J. M. Paper	.30 per ft.
		$ .59 per ft.
Labor:	(Aircell	$ 1.50 per ft.
	(J. M. Paper	.12 per ft.
		$ 1.62 per ft.
Aircell total cost:		$ 2.21 per ft.

AIRCELL WITH ALUMINUM FOIL



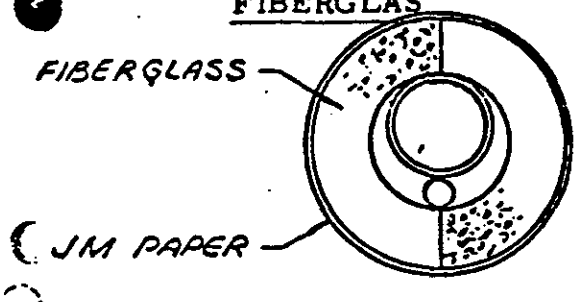
Material:	(Aircell	$ .29 per ft.
	(J. M. Paper	.30 per ft.
	(Aluminum foil	.09 per ft.
		$ .68 per ft.
Labor:	(Aircell	$ 1.50 per ft.
	(J. M. Paper	.12 per ft.
	(Aluminum foil	.03 per ft.
		$ 1.65 per ft.
Aircell with aluminum foil total cost:		$ 2.33 per ft.

AIRCELL WITH THERMON



Material:	(Aircell	$ .29 per ft.
	(J. M. Paper	.30 per ft.
	(Thermon	.40 per ft.
		$ .99 per ft.
Labor:	(Aircell	$ 1.50 per ft.
	(J. M. Paper	.12 per ft.
	(Thermon	.26 per ft.
		$ 1.88 per ft.
Aircell with thermon total cost:		$ 2.87 per ft.

FIBERGLAS



Material:	(Fiberglas	$ .43 per ft.
	(J. M. Paper	.30 per ft.
		$ .73 per ft.
Labor:	(Fiberglas	$ 1.50 per ft.
	(J. M. Paper*	.30 per ft.
		$ 1.80 per ft.
Fiberglas total cost:		$ 2.53 per ft.

*J. M. Paper wired on Fiberglas vs. stapled on Aircell

ST0000310

DOW 00106

EXHIBIT IV

COMPARATIVE INSULATION MATERIAL COSTS

Size (inches)	1967 Usage of Aircell (feet)	1969 Prices (per ft.) Aircell	Fiberglas
1/2	400	$ .18	$ .29
3/4	1500	.19	.31
1	4000	.22	.34
1-1/4	6000	.24	-
1-1/2	9000	.26	.40
2	11000	.29	.43
2-1/2	20000	.32	.46
3	6000	.36	.50
3-1/2	3500	.40	.55
4	3000	.48	.65
5	2500	.56	-
6	7000	.64	-
8	4000	.88	1.46
4-1/2	3000	.52	.69
12	1500	1.48	-
7			1.18

82,400' of Aircell used in 1967

TJM
7-24-69

EXHIBIT V

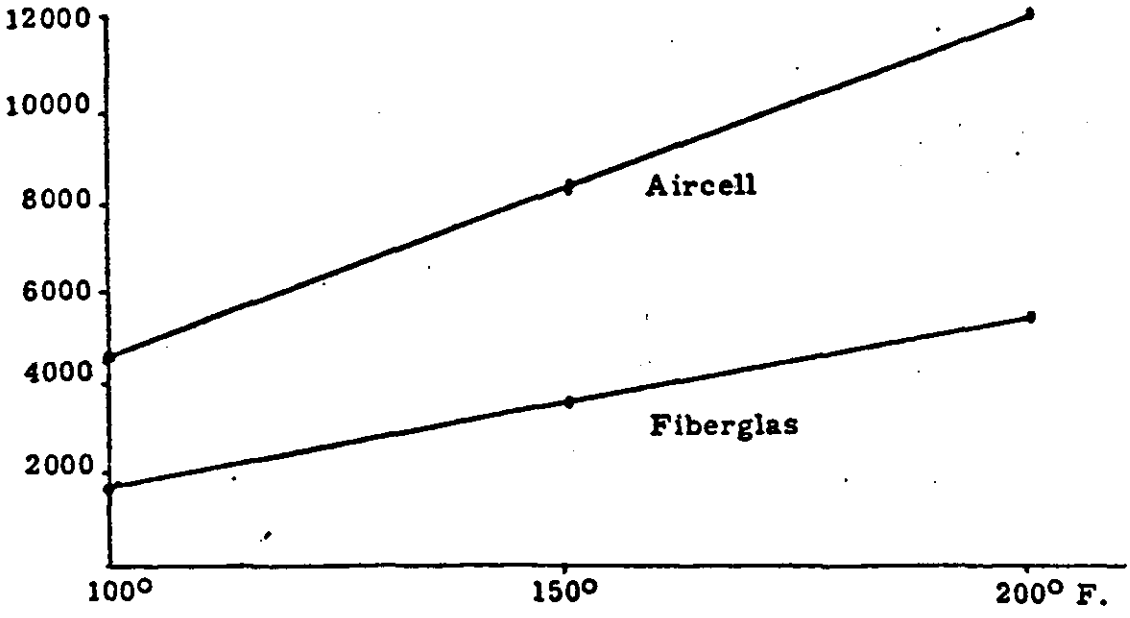
THEORETICAL HEAT LOSS COMPARISON BETWEEN AIRCELL & FIBERGLAS INSULATION

Conditions: 3/8 inch tracer with 150# steam on a 2 inch product line 200 feet long. Insulation thickness 3/4 inch

Assume: That heat from 1/2 of the area of the tracer is absorbed by the product and heat from the other half goes to ambient (70°F.) thru the insulation.

Equation: $Q = \frac{k A \Delta t}{\Delta x}$

where: Q = BTU/hr. heat loss
k = Thermal conductivity
A = Area of pipe surface
Δt = Temperature difference between tracer (370°F.) and surfaces being heated.
Δx = Insulation thickness in inches



At a product temperature of 150°F. the heat loss difference between Aircell and Fiberglas is about 4500 BTU/hr. per 200 feet 2 inch line. This represents 3.75 lbs. of steam/hr. or $23 per year.

DOW 00108

Roy Anderson
ACP & OCP Maintenance

ST0000312

INSULATION SAFETY TASK FORCE

Questions to be answered:

1. What are the health problems caused by some of our present insulating materials?

2. What insulation materials have these characteristics?

3. What precautions must be taken when working with these?

4. What are the added costs for taking these precautions?

5. What alternate insulation materials are available?

6. What are the health problems connected with them and what precautions must be taken?

7. What are the costs involved in relationship to the present materials?

8. What insulations do other plants use and what problems do they have?

9. What is the life expectancy and the performance of the alternate insulations vs. the currently used insulations?

10. What are the net annual Division costs (savings) in changing our insulation practices?

11. What is the best method of communicating this change in practice to, and receive support from, the Division Staff, plant supervision, maintenance supervision, and the Pipecoverers?

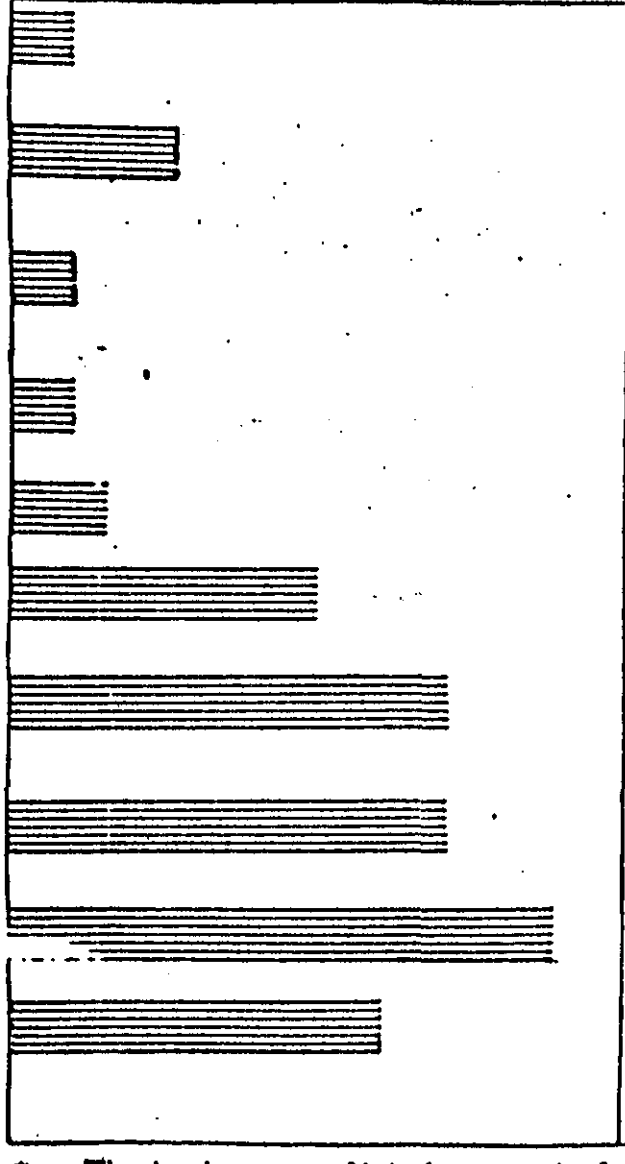
12. What has to be done and how long will it take for the proposed change to become a reality?

TJM
6-17-69

INSULATION ATA SHEET

FOR ABOVE AMBIENT TEMPERATURES

ST0000314



Type*	Notes
Aircell	65% asbestos. Should use respiratory protection. Used on many temperature applications above the recommended limit.
Fiberglas	Asbestos free. A strong, semi-rigid, resilient material. Used almost exclusively by the trade except by Dow maintenance people for this temperature range.
Armaflex	A closed cell flexible, rubber type material. Excellent insulation for low temperature applications, particularly refrigeration.
Thurane	Rigid preformed polyurethane. Excellent low temperature material. More fire retardant than Styrofoam.
Polyurethane Foam	A sprayed or poured foam. Has good potential for a limite temperature range. Priced very favorably.
Foamglas	A lightweight, rigid, cellular glass material. Excellent for dual temp. applications. Quite friable and time consuming to apply.
Kaylo	Calcium-Silicate with 15-20% asbestos fiber. Should use respiratory protection. Is quite dusty and friable. Has good insulating qualities.
Unibestos	70-80% asbestos fiber. Shock resistant. Not dusty. Not extensively used in maintenance.
Careytemp 1500	Expanded perlite with 6% asbestos. New from Phillip-Car Usage similar to Calcium-Silicate.
Insulating Cement	10-15% asbestos fiber. Commonly used with Aircell and Calcium-Silicate systems. Should use respiratory protection. Two companies are marketing a cement which is asbestos free.

* The trade names listed are typical of several similar materials on the market.

Roy Anderson
AC [illegible] OCP Main

THE DOW CHEMICAL COMPANY

MIDLAND, Michigan
June 24, 1969

L. Warren, FSU #6, 189 Building
R. Wood, FSU #11, 49 Building
H. Ahlich, FSU #2, 759 Building
B. Vander Klipp, Distribution Department, 572 Building
T. J. Madden, FSU #10, 222 Building
G. Bradley, Plastic Prod. Maintenance, 433A Building
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D. B. Morse, Safety Department, 401 Building
S. M. MacCutcheon, Safety and Loss Prevention, 2030 ARC
R. J. House, Division Accounting, 256 Building

REPORT BC T2.1-1-64: "A SURVEY AND EVALUATION OF PIPE COVERERS' EXPOSURES TO DUSTS FROM ASBESTOS CONTAINING INSULATION MATERIALS ENCOUNTERED DURING ROUTINE PIPE COVERING OPERATIONS WITHIN THE MIDLAND LOCATION OF THE DOW CHEMICAL COMPANY"

Please note the following corrections in the above report dated March 21, 1969, by R. A. DeGesero.

Page 6: Line 5, change 4.5 mppcf to 4.2 mppcf.

Page 7: Line 10, erase 0.037 under the last column entitled Time-weight Factor: Asbestos.

Page 8: Line 7, erase 0.176 under the last column entitled Time-weight Factor: Asbestos.

Line 14, erase 0.162 under the last column entitled Time-weight Factor: Asbestos.

Line 22, change the last entry in the last column entitled Time-weight Factor: Asbestos, from 4.5 to 4.2 mppcf.

The above alterations in no way affect the conclusions or recommendations of this report.

Roy A. DeGesero

R. A. DeGesero
Biochemical Research Laboratory
1701 Building
6-4759

RAD:sjl

ST0000315

DOW 00111

Biochemical Research Laboratory

The Dow Chemical Company

A SURVEY AND EVALUATION OF PIPE COVERERS' EXPOSURES TO DUSTS FROM ASBESTOS CONTAINING INSULATION MATERIALS ENCOUNTERED DURING ROUTINE PIPE COVERING OPERATIONS WITHIN THE MIDLAND LOCATION OF THE DOW CHEMICAL COMPANY

File: T2.1-1-64
Date: March 21, 1969
By: R. A. DeGesero

Signed Roy A. DeGesero Date March 24, 1969

Checked A R Hoyle Date March 24, 1969

PROBLEM

Supervision requested that the Environmental Research Laboratory survey and evaluate current levels of pipe coverer's exposures to dusts from asbestos-containing insulation materials commonly used within the Midland location.

CONCLUSIONS

1. The present Threshold Limit Value (TLV) for asbestos of 5 mppcf will remain in force until 1971. Barring information to the contrary, the TLV will then be lowered to 2 mppcf (million particles per cubic foot).

2. Men are encountering time-weighted exposures to dusts from insulation materials containing asbestos approaching but not exceeding the present TLV of 5 mppcf.

3. Men are encountering time-weighted exposures to dusts from insulation materials containing asbestos exceeding the proposed TLV of 2 mppcf.

4. If exposures are to be reduced to within tentatively accepted levels (2 mppcf) either the use of asbestos-containing insulation materials must cease, or pipe coverers must be protected through effective use of approved respiratory devices and/or local ventilation.

RECOMMENDATIONS

1. Pipe coverers should be educated to the true hazards associated with the several types of insulating materials they presently use.

2. Pipe coverers should be made aware of the several ways of protecting themselves during unavoidable, potential exposures to dusts containing substances known to be highly toxic, such as asbestos.

3. In the future, pipe coverers should be educated to the true hazards associated with any new types of insulation materials to be used, prior to use.

PRESENTATION OF DATA

Indoor pipe covering operations were surveyed from 12/24/68 to 1/22/69. Outdoor pipe covering operations were surveyed from 2/20/69 to 3/5/69. Air samples to account for "miscellaneous" portions of the pipe covering functions were obtained from 3/1/69 to 3/5/69.

Sampling and Analysis

A total of 141 breathing zone samples were collected in midget impingers and analyzed employing standard light field microscopy techniques for determining dust concentrations from insulating materials containing asbestos. Concentrations found in samples were expressed in terms of millions of particles per cubic foot of air (mppcf), according to the following formula.[1]

$$\text{mppcf} = \frac{(\text{mean particles/quarter field}) \times 4 \times 1000 \times \text{sample volume}}{\frac{\text{liters}}{\text{min.}}\ (\text{pump flow}) \times \text{minutes} \times 3.51 \times 10^{-2}\ \frac{\text{ft}^3}{\text{liter}}}$$

[1] Patty, F. A., INDUSTRIAL HYGIENE AND TOXICOLOGY, Vol. I. Second Revised Edition, p. 198.

The means and ranges of concentrations found during sampling are listed in Table 1.

Job Analysis and Description

An environmental job analysis provides an estimate of the frequency and duration of men's exposures to dust concentrations surveyed. The job analysis expresses as per cent of the day (% day) the probable time distribution of pipe covering operations, averaged over several months. On any given day the pipe coverer's routines can be expected to vary from the estimate.

The job analysis reconciled input from discussions with pipe coverers and supervision, observations during sampling, estimates provided by an industrial engineering time study, and a questionnaire filled out by the pipe coverers. A sample questionnaire is found on page i of the Appendix.

The questionnaire requested that men estimate the per cent of time per day they spent working with the most common insulating materials. Men's averages were converted into ratios of time spent (% day) per operation and material, and are listed in Table 1.

Thirty-two per cent (26 men) of the Midland coverers responded. Responses concerning rarely used materials (e.g., cork, styrofoam, some putty adhesives, etc.) were set aside. Other information furnished by the coverers included:

Average age:	40 years
Years covering within Dow:	18
Years covering outside Dow:	0
Wear respirator?	Yes: 17 men; No: 9 men
Which material(s) are the dustiest?	Kaylo: 16 men Fiberglas: 14 men High temp.: 11 men Superpower: 6 men Mag oxide: 2 men Aircell: 2 men

Time-Weighting Exposures

Men's exposures to dusts from asbestos-containing insulation materials were [illegible]d by "time-weighting." The exposure frequency and duration (% day) to each material is multiplied by the mean concentration in air of each material, giving a set of "time-weighted factors." The "factors" (product of % day x mean concentration) are then added up for the eight hour day:

$$\text{Time-Weighted Exposure} = \sum_{1=0}^{100\%} \%\ \text{day} \times \text{concentration}$$

$$\text{or,} \quad \sum_{1=0}^{100\%} = (\text{time-weight factors})$$

Table 1 lists the % day, mean concentrations found, time-weighted factors and ranges for each material encountered in the listed operations. The time-weighted exposures to dusts from asbestos containing materials were 4.9 mppcf (indoor operations) and 4.5 mppcf (outdoor operations).

Table 1. TIME-WEIGHTED EXPOSURES OF PIPE COVERERS TO DUSTS FROM ASBESTOS CONTAINING MATERIALS

Operations	Materials	% Day	Concentrations (mppcf) Mean	Range	Time-weight Factor: Asbestos
Remove	Air cell	1.2	11.4	0.3-24.9	0.137
	Kaylo	1.6	11.2	3.7-20.5	0.179
	Mag oxide	0.2	2.8	1.8-4.6	0.006
	Fiberglas	2.0	13.7	1.2-33.7	---
Mix	No. 1 Plus	1.6	13.4	2.2-30.5	0.219
	Armentite	0.1	9.6	2.7-13.5	0.010
	Superpower	.8	34.9	19.6-6.14	---
Cut	Air cell	5.	3.0	0.6-6.2	0.177
	Kaylo	8.8	11.7	4.9-23.1	1.030
	Fiberglas	2.2	1.7	0.8-2.6	0.037
	Others	0.6	--	---	---
Apply	Air cell	15.8	5.7	0.2-16.4	0.901
	Kaylo	19.9	5.7	0.4-22.3	1.123
	Fiberglas	4.5	2.4	1.2-3.8	---
	Others	2.6	--	---	---
	No. 1 Plus	4.8	9.6	1.1-39.5	0.461
	Armentite/ Superpower	2.4	2.1	0.9-3.9	0.050
Clean up removed covers		3.0	8.5	2.4-24.6	0.255
Stocking; get new covers		2.0	1.0	0.1-2.3	0.020
Move to job, set up		5.0	2.0	1.4-2.9	0.100
Breaks, lavatory		15.0	1.4	0.1-3.9	0.201
Time-weighted exposure to asbestos containing dusts (indoor) in mppcf					= 4.9

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DOW 00118

Table 1. CONTINUED

Operations	Materials	Day	Concentrations (mppcf) Mean	Range	Time-weight Factor: Asbestos
Remove	Air cell	1.2	5.2	5.1-5.2	0.062
	Kaylo	1.6	9.0	3.6-14.0	0.144
	Fiberglas	2.0	10.0	5.5-20.2	---
	Others	0.2	--	---	---
Mix	No. 1 Plus	1.6	9.6	5.9-12.5	0.154
	Armentite	0.1	17.0	14.1-21.6	0.017
	Superpower	0.8	21.3	13.1-25.4	0.176
Cut	Air cell	5.9	2.5	0.9-3.4	0.148
	Kaylo	8.6	9.4	6.3-7.4	0.827
	Fiberglas	2.2	2.5	1.4-3.8	---
	Others	0.6	--	---	---
Apply	Air cell	15.8	1.5	0.3-3.5	0.237
	Kaylo	19.9	9.2	1.9-17.9	1.831
	Fiberglas	4.5	3.6	1.6-6.7	0.162
	Others	2.6	--	---	---
	No. 1 Plus	4.8	1.4	0.3-2.3	0.067
	Armentite/ Superpower	2.4	5.2	3.5-7.9	0.125
Clean up removed covers		3.0	8.5	2.4-24.6	0.255
Stocking; get new covers		2.0	1.0	0.1-2.3	0.020
Move to job, set up		5.0	2.0	1.4-2.9	0.100
Breaks, lavatory		15.0	1.4	0.1-3.9	0.210

Time-weighted exposure to asbestos containing dusts (outdoor) in mppcf = 4.5

ST0000323

Threshold Limit Values (TLV)

A TLV describes that time-weighted concentration of a material to which men can be repeatedly exposed for eight hours with no adverse effects on th. A TLV indicates a mean concentration which can be exceeded, provided there are corresponding exposures lower than the TLV.

At present the TLV for dust containing asbestos is 5 mppcf using standard light microscopy techniques. Based on best current information, the proposed TLV of 2 mppcf would provide better protection. A two year trial per preceeds acceptance of proposed TLV's. In 1971, 2 mppcf will be the TLV for asbestos, unless better information during the interim casts doubt upon the proposed figure.

This report evaluated current exposures using the proposed standard of 2 mppcf if the material in question had even trace (<5%) asbestos content. Manufacturers were consulted regarding the composition of the insulating product(s) found in common usage. The following table lists these materials and the per cent asbestos plus the appropriate TLV for th material.

Table 2. MATERIALS MOST COMMONLY USED FOR FIRST TEN MONTHS OF 1968

Tradename (and Manufacturer)	Use	% Composition Asbestos	% Composition Inerts	Threshold Limit Value (mppcf)
No. 1 Plus (BEH Company)	Adhesive	<5-7%	95% mineral wool	2.0
Superpowerhouse (BEH Company)	Adhesive	0%	100% mineral wool	50.0
Armentite (Johns-Manville Corporation)	Adhesive	100%	0%	2.0
Air cell (Carey Company)	Covers	80%	20% (?)	2.0
Mag Oxide (85%) (Carey Company)	Covers	15%	85% MgO	2.0
Fiberglas (Owens-Corning)	Covers	0%	100% amorphous silicates	50.0
Kaylo (Owens-Corning)	Covers	~5%	95% diatomaceous calcium silicates	2.0

DOW CHEMICAL U.S.A.

MIDLAND, MICHIGAN 48640

MICHIGAN DIVISION
December 10, 1975

G. T. Corbat
Purchasing
47 Building

cc: J. T. Badley 49
R. R. Langner 1803
R. W. Price 824

INSULATION WEATHERPROOFING PAPER

I have talked with Bob Price and Jack Badley about the insulation weatherproofing paper we talked about the other day. Both agree that you can now proceed with the stop order you have for DVS of the Johns-Manville and/or Carey-Temp papers. I understand we are getting only the J-M paper at present.

From an Industrial Hygiene standpoint this will help to eliminate another source of asbestos exposures in the Michigan Division and we support this move.

R. D. Olson

no - were getting "Dur all".

Richard D. Olson
Industrial Hygiene Services
607 Building

jal

ST0000326

DOW 00122

M.T.S 9-15-76
CC: E. Patten
G. Wisniewski
C. Richie
B. Kocher
File

DOW CHEMICAL U.S.A.

MIDLAND, MICHIGAN 48640

MICHIGAN DIVISION
September 14, 1976

Milt Strom,
General Services
49 Building

cc: T. J. Paquet, Division Engineering, 821 Building

HANDLING OF WEATHER-PROOF PAPER

Both the Johns-Manville and Phillip Carey weatherproofing paper used around insulation contain asbestos which can become air-borne. This type of paper should no longer be applied to insulation in the Michigan Division. It is no longer available from DVS. There are however many miles of pipe in the plant that are covered with this product. Since it does contain asbestos it should be treated essentially the same as asbestos insulation. These handling procedures can be found in Michigan Divison Safety Standard SS-140. These procedures include wetting the material before removal, bagging in plastic bags, labeling with proper labels and sending it to land fill.

It has been brought to my attention that some of these procedures are not being followed when the paper is removed from the insulation.

I would appreciate it if you would pass this reminder on to your maintenance network so they can get it back to their supervisors.

Thank you for helping in this communication.

Dick
Richard D. Olson JDL
Industrial Hygiene Services
433 Building

jal

ST0000327

DOW 00123

LIFE IS FRAGILE HANDLE WITH CARE

Trade name(1)	Composition	Temperature Range	Forms Available	K Factor	Equivalent Cost(2)		Comments
			Currently Available on DVS				
Aircell	Corrugated Asbestos Sheet	Ambient to 200° F.	Preformed Pipe	.75	3/4"x12"	$.22	A very poor insulating material. Very little used outside of Midland Division. Should only be used as protective pipe cove
Kaylo	Calcium Silicate	300° to 1200° F.	Molded Pipe & Block	.40	1"x12"	$.31	A good insulating material. Quite friable. Contains about 35% asbestos.
Fiberglas	Bonded Glass Fibers	-120° to 450° F.	Molded Pipe & Blankets	.29	3/4"x12"	$.34	A strong, semi-rigid & resilient insulating material. Availab with a variety of vapor barrier & weatherproof jackets.
Armaflex	Molded Foam Rubber	32° to 200° F.	Molded Pipe Covering	.28	1/2"x12"	$.30	An excellent covering for copper tubing having many bends. Recommended for use on dual temperature lines.
Styrofoam	Expanded Polystyrene	-200° to Ambient	Preformed Pipe & Boards	.24	1"x12"	$.46	Excellent for low temperature insulation.
			Other Available Recommended Materials				
Unibestos	Molded Asbestos Fibers	300° to 1200° F.	Molded Pipe & Block'	.30	1"x12"	$.40	A more durable form than Calcium Silicate. Generally used o high pressure steam transmission lines.
Careytemp 1500	Expanded Perlite	300° to 1500° F.	Molded Pipe & Block	.42			A brand new material from Phillip-Carey. Priced similar to Cal-Sil. Has a very low asbestos content--less than 5%.
Thurane	Polyurethane Foam	-200° to +200° F.	Preformed Pipe & Boards	.15	1"x12"	$.80	An excellent material for low temperatures. Must be protecte from sunlight. More fire retardant than styrofoam.
Sprayed Polyurethane	Foamed in Place Insulation	-200° to +200° F.	Sprayed or Form Poured	.15	1"x12"	$.30	We have had but little experience with this product. Vapor barrier protection will be very important.
Foamglas	Expanded Cellular Glass	-450° to +800° F.	Preformed Pipe & Blocks	.40	1"x12"	$.35	A high density, excellent dual temperature material. Quite time consuming to apply. Dow is entering this market with a new material called Ceramic Foam.

(1) The trade names are typical of several similar materials on the market.

(2) Costs are based on covering for 1-inch pipe size in the thickness listed and 12 inches long. A great number of jackets are available, both attached and separate. The cost of these would be in addition to the prices listed above.

Roy Anderson
5-20-69

ST0000328

DOW 00124

DISCUSSION

Men were found to be working almost exclusively with asbestos-containing mater. Their time-weighted exposures to dusts from the asbestos-cont. ing materials were in excess of the proposed TLV of 2.0 mppcf and barely under the present TLV of 5 mppcf. Steps should be taken to lower the time-weighted exposures to within proposed acceptable limits.

Several means of reducing the time-weighted exposures are apparent:

1. Cease using asbestos-containing materials. If use of asbestos-containing materials was stopped, exposures would be reduced to acceptable levels, even though some low-level exposure would be experienced until presently installed coverings have been replaced due to natural attrition.

2. Effective use of approved respiratory devices. Respiratory protection is practical for jobs which are of short duration and infrequent occurrence. It can be seen from Table 1 that jobs requiring respiratory protection are neither infrequent nor of short duration. Men encounter greatest exposures during the cutting and applying of Air cell and Kaylo. These two operations are done for 50% of the day -- sometimes 100% of the day. Many other operations listed in Table 1 could require

use of respiratory devices. Attempts to lower exposures to 2 mppcf by using respirators seem futile.

3. Use local ventilation. This method would be effective if the ventilation could be kept close to the dust source. Pipe coverers' work routines make this difficult; e.g., working aloft, or in cramped areas.

In the event new types of covering materials are used, men should be instructed regarding the toxic properties of the materials and the hazards associated with using the material. Protective measures to prevent or lower undesirable but unavoidable exposures to the material should be well understood. Any education effort must precede or be concurrent with first usage of new materials.

During this survey, most men voiced strong objection to fiberglas, asserting that fiberglas insulation materials were far more hazardous than asbestos insulation materials. This contention is not supported by 25 years available field experience and independent laboratory testing on fiberglas.

The Environmental Research Laboratory will survey and evaluate upon request any proposed types of insulating materials and relate their usage to the health hazards associated with these materials.

UNIT INDEX

Pipe covering operations were surveyed and evaluated. Men received time-weighted exposures to asbestos near the present Threshold Limit Value of 5 mppcf and in excess of the tentatively proposed Threshold Limit Value of 2 mppcf. Steps should be taken to reduce exposures to the proposed new standard.

DISTRIBUTION

L. Warren, Field Service Unit #6, 189 Building
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H. Ahlich, Field Service Unit #2, 759 Building
B. VanderKlipp, Distribution, 572 Building
T. J. Madden, Field Service Unit #10, 222 Building
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D. B. Morse, Safety Department, 401 Building
S. M. MacCutcheon, Safety and Loss Prevention, 2030 ARC
R. J. House, Division Accounting Staff, 256 Building

RAD:sjl

THE DOW CHEMICAL COMPANY

Midland Division
April 16, 1969

J. M. Scovic
Mgr. of Services
47 Building

EXPOSURES TO DUSTS FROM INSULATING MATERIALS
CONTAINING ASBESTOS

The following are the plans for continuing attention to this problem:

1. Medical's presentation to Mr. Bosscher's staff A.S.A.P., citing problems and solutions.

2. Presentation to the Union Committee immediately thereafter.

3. Presentation to the coverers in the two days following the Union Committee session. This would be in 4 - 20 man groups.

I will be glad to give you a "brief" on this at your convenience.

Jack

M. T. Badley
Mgr. Field Const. & Maint.
49 Building

ST0000332

DOW 00128

APPENDIX

ENVIRONMENTAL RESEARCH QUESTIONNAIRE

Please answer the following questions as completely as possible, using age estimates.

Name _____ Man # _____ Age _____

Number of years with Dow _____. Number of years covering pipe _____

Do you wear a respirator? Yes ___ No ____ What make _____

If yes, list those operations during which you wear a respirator _____

_____

What per cent of the day is this? _____

Have you covered pipe or handled covering materials outside of Dow? _____

Yes _____ No _____ If yes, how long did you cover pipe? _____

Answer the following if they apply to you.

How much time per day do you:

(a) Remove old fiberglas covers? _____

(b) Remove other types of covers? _____

List other types you remove: _____

_____

(c) Mix "plus one" webbers? _____ Other adhesives? _____

(d) Use power saws? _____

List what you cut with a power saw: _____

_____

(e) Use hand saws? _____

List what you cut with a power saw: _____

_____

How much time per day do you:

(a) Work with "air cell" _____

(b) Work with "Kaylo" _____

(c) Work with "Hi-temp" _____

(d) Work with fiberglas _____

Which job(s) do you consider most dusty? _____

_____

How often do you do this job(s)? _____

_____

ST0000333

DOW 00129

PLEASE RETURN FILLED OUT FORM TO: LARRY WARREN, 189 BUILDING

INSULATION STANDARDS

FOR

PIPING AND EQUIPMENT

This Publication was prepared expressly for use by the Employees of The Dow Chemical Company and its subsidiaries.

DOW

ENGINEERING DEPARTMENT
THE DOW CHEMICAL COMPANY
Midland, Michigan
December, 1952

ST0000334

THIS COPY ISSUED TO---------- SHEET. OF

MADE: W. A. D.	THE DOW CHEMICAL COMPANY, MIDLAND, MICH.	INSULATION STANDARDS
CHECKED:	TITLE SHEET	
APP'D:		IN-000
DATE 12-12-52	REVISION DATE:	

GENERAL NOTES

Piping and Equipment Insulation Standards have been prepared expressly for use by employees of The Dow Chemical Company and Contractors engaged by the Company. These Standards have been designed to fill requirements of the Engineering, Purchasing and Pipe Shop Departments of the Company and similar requirements of outside Contractors engaged in Company work.

1. DESIGN and BILLING NOTES

Designers shall pay particular attention to the various thicknesses for the different pipe sizes to insure providing necessary clearance between parallel piping; or piping close to walls, ceilings or equipment.

Designers shall specify size and quantity of insulation required for blocking across flanged pipe fittings and valves, weld-end valves, equipment nozzles and other equipment flanges which are to be insulated. These items are often overlooked and are not available unless they are billed, listed and purchased for respective applications.

Bills of Material shall list the following:

a. Kind, type, size and quantity of insulation proper.
b. Kind, type, size and quantity of insulation for blocking in flanged fittings, valves, nozzles, etc.
c. Quantity of weatherproof felt if required.
d. Quantity of galvanized sheet metal if required.
e. Sundry materials shall be billed as "One lot of Sundries consisting of muslin, paste, staples, asphalt mastic ...etc." Refer to Sundries, IN-203.

2. JOB PREPARATORY WORK

a. All surfaces shall be clean before applying insulation. All loose scale, dirt, etc., shall be removed, wire brushing where necessary.
b. Vessels for hot insulation do not require sand blasting and painting unless in badly rusted condition.
c. Vessels for cold insulation shall be sandblasted and painted one prime coat in the shop and a second coat of the same in the field.
d. All piping and equipment shall be tight before insulation is applied. Testing for tightness, particularly in new construction, should precede application wherever practical and possible.
e. Piping and equipment shall not be covered in wet or frosted condition. This shall be especially adhered to in cold insulation work.

3. INSULATION JOINTS

All insulation joints shall be true, even and firmly butted together. Styrofoam and cork joints shall be sealed and made absolutely tight against entry of moisture.

4. WIRE and BAND FASTENERS

All wires and bands shall be applied straight and drawn tight so as to prevent loosening. Kinking of wire loops in order to take up slack is prohibited.

5. GALVANIZED IRON SHEET. Uses and Application

A. PIPING No.26 ga.galvanized iron sheet shall be used on insulated pipe as follows:

1. Wherever necessary to protect insulation from physical damage.
2. On covered lines to a point 8 ft.above floor or platform but only when necessary to protect them.
3. On all covered lines wherever it may be necessary for operators to step over them in line of duty.
4. Application Precedure.
   Follow the same general procedure as outlined for Weatherproof Felt, IN-481. All laps shall be sizes as specified on IN-482. All horizontal laps shall be positioned so as to shed water and shall be concealed as far as possible. All laps shall be fastened with size No.7 x 1/2" RH sheet metal screws, (P-K or approved equal) placed on 4" centers. Use 7/64" drill.

   For width dimensions of sheet metal strips for various covered pipe sizes refer to IN-482.

B. EQUIPMENT. Unless otherwise specified use 26 ga.galvanized iron sheet, fastened with No.7 x 1/2" RH metal screws (P-K or approved equal) on 4" centers. Paint as per Dow Painting Specs.

6. INDOOR and WEATHERPROOF FINISH.

See various Application Sheets for detailed methods.

a. Indoor Finish is designed for indoor use only where conditions provide general indoor protection.
b. Weatherproof Finish is designed for out-of-doors or where insulation will be exposed to excessive moisture, water or corrosive conditions. Where such conditions exist indoors, Weatherproof Finish shall be used.

7. PAINTING

Insulation shall be painted, where called for, according to the latest Dow Manual of Painting Specifications of the Midland Plant, unless otherwise specified. Copies of this manual are obtainable from the Dow Paint Department.

MADE: S.E.F.	THE DOW CHEMICAL COMPANY, MIDLAND, MICH.	INSULATION STANDARDS
CHECKED: WAT.	GENERAL NOTES	DOW 00132
APP'D: GDM		

ECONOMIC THICKNESS AND AMORTIZATION POLICIES

For the purpose of calculating the size and thickness of thermal insulations, pipe lines and equipment shall be classified and insulation shall be designed in accordance with the policies outlined below. Since it is not possible to list all conditions which may be encountered, this outline will serve as a guide for special cases.

1. Long Term Investment Class

Insulation for pipe and equipment in this class shall be designed to produce an "annual rate of return on the investment" of not less than 20 percent. This corresponds to an amortization period of 5 years on the total installed cost of the insulation.

Included in this class are:

a. Steam distribution mains.
b. Main steam lines and principle equipment in Power Houses, Pump Houses, Boiler Rooms, etc.
c. Pipe lines and equipment in permanent laboratories, shops, etc.
d. Permanent refrigeration and air conditioning system.

2. Short Term Investment Class.

Insulation in this class shall be designed for an annual rate of return on the investment of 35 percent, or an amortization period of within 3 years.

a. Included here are branch or connecting lines from distribution mains to operating equipment.
b. Include also process piping and process equipment in general. However, operating conditions may dictate the type, kind and thickness of insulation in order to meet process requirements.

3. Minimum Thickness Class

a. Piping and equipment in pilot or semi-plants shall use minimum thickness of insulation, or be designed for 100 percent annual return (one year amortization) whichever results in the greater thickness.
b. Pipe lines heated by steam or water tracer lines shall be covered with 3/4" thick 3 ply Air cell insulation. See IN-305.
c. Insulation required for safety or protection of personnel shall be minimum thickness or greater if necessary, to insure outer surface temperatures of not over 135 degrees F.

ST0000337

MADE: W.A.D...	THE DOW CHEMICAL COMPANY, MIDLAND, MICH.	INSULATION STANDARDS
CHECKED: W.A.D.	ECONOMIC THICKNESS AND AMORTIZATION POLICIES	
APP'D: [illegible]	DOW 00133	

The following tables have been prepared to simplify selection of type and thickness of insulations and may be used in most cases. However, for long pipe lines and large items of equipment, where the amount of insulation so justifies, separate economic studies should be made.

Piping Insulation Selection Chart	IN-101
Equipment Insulation Selection Chart	IN-102
85% Magnesia Thickness Table	IN-103
Kaylo Thickness Table	IN-104
High Temp. Thickness Table	IN-105
Fiberglas & Mineral Wool Thickness Table	IN-106

ST0000338

MADE: W.A.D.	THE DOW CHEMICAL COMPANY, MIDLAND, MICH.	INSULATION STANDARDS
CHECKED: Walz.	ECONOMIC THICKNESS AND AMORTIZATION POLICIES	
APP'D: [illegible]		
DATE 3-10-50	REVISION DATE: 12-9-52	IN-202-2

8. ASPHALT MASTIC

a. Where asphalt mastic is to be used on equipment insulation, the insulation is first covered with 1" hex.mesh galvanized iron netting, laced on smooth and tight. The asphalt mastic shall be applied in two separate coats, each coat 1/8" thick. It shall be trowelled to a smooth finish and be 1/8" thick when dry.

b. Valves and fittings, 14" and larger, shall be finished as per (a).

c. Valves and fittings less than 14" size do not require the hex.mesh netting.

9. SMALL DIAMETER VESSELS

For vessels 3'-0" in diameter and smaller, use molded pipe insulation (sectional) or curved blocks on the bodies, and flat blocks on the heads. On small dished heads with diameter 18" or less, mineral wool cement may be used as an alternate to blocks.

10. STANDARD PLANT WATER HEATERS

Bodies and heads of these units shall be insulated with 85% Magnesia and covered with 1/4" asbestos cement, finished rough, and overlaid with 1/4" hard finished cement trowelled smooth. For hard finish cement formula, refer to IN-204-2. Paint as per Dow Painting Specifications.

Coil flanges, hand holes or other removable openings used for maintenance shall not be covered.

MADE: S.P.F.	THE DOW CHEMICAL COMPANY, MIDLAND, MICH.	INSULATION STANDARDS
CHECKED: WHX.	GENERAL NOTES	IN-201-3
APP'D: CDA		
DATE 3-10-50	REVISION DATE: 12-9-52	DOW 00135

SUNDRIES

ST0000348

The following materials are required in the application of piping and equipment insulations. They are Dow Stock and/or Austin 5658 items. Respective stock code numbers are listed accordingly.

To simplify their handling on bills of material; it is not required to bill out sundries in detail with the exception of weatherproof felt. Refer to Design and Billing Notes, IN-201-1.

INSULATING CEMENTS

1. **Forty Eight Cement**

   Dow Stock Code No.200270
   Austin 5658 Code No.30028

   A mineral wool cement for use up to 1800°F. Supplied by Forty Eight Insulations, Inc., in 50 Lb.bags. Coverage 25 sq.ft.1" thk.per bag.

2. **Super "66" Cement**

   Dow Stock Code No.200294
   Austin 5658 Code No.30029

   A mineral wool cement for use up to 1800°F. Supplied by Eagle Picher Co., in 50 Lb.bags Coverage 25 sq.ft.1" thk per bag.

3. **MW No.50 Cement**

   Dow Stock Code No.
   Austin 5658 Code No.30030

   A mineral wool cement for use up to 1800°F. Supplied by Philip Carey Mfg. Co., in 50 Lb.bags.Coverage 25 sq.ft., 1" thk.per bag.

4. **B-H No.1 Cement**

   Dow Stock Code No.
   Austin 5658 Code No.30031

   A mineral wool cement for use up to 1800°F. Supplied by Baldwin-Hill Co., in 50 Lb.bags. Coverage 25 sq.ft., 1" thk. per bag.

5. **85% Magnesia Cement**

   Dow Code No.200268
   Austin 5658 Code No.30032

   A magnesia base cement for use up to 600°F. Available from Dow Stock in 50 Lb.Fiberpaks and J-M,Philip Carey and others in 60 Lb.bags.Coverage 30 and 35 sq.ft.respectively; 1"thk.per bag.

INSULATING FINISHING CEMENTS

6. **No.152 Cement**

   Dow Stock No.
   Austin 5658 Code No.30008

   An asbestos base finishing cement for use up to 1000°F. Supplied by Armstrong Cork Co.in 100 Lb.bags. Coverage 19 sq.ft,1" thk. per bag.

7. **No.352 Cement**

   Dow Stock Code No.
   Austin 5658 Code No.30009

   An asbestos base finishing cement for use up to 1000°F.Supplied by Johns-Manville in 100 Lb.bags. Coverage 19 sq.ft,1" thk. per bag.

8. **No.303 Cement (or 7W)**

   Dow Stock Code No.200271
   Austin 5658 Code No.30010

   An asbestos base finishing cement for use up to 1000°F.Supplied by Philip Carey Co., in 100 Lb.bags. Coverage 19 sq.ft.1" thk. per bag. Also known as 7W cement.

MADE: S.P.F.	THE DOW CHEMICAL COMPANY, MIDLAND, MICH.	INSULATION STANDARDS
CHECKED: [illegible]	INSULATION SUNDRIES	IN-203-1
APP'D: [illegible]		
DATE 3-10-50	REVISION DATE: 12-9-52	

ASPHALT MASTIC CEMENTS — For Weatherproof Finish

13. Thermotex
Dow Stock Code No.200263
Austin 5658 Code No.30591
Supplied by Philip Carey Co.in 50, 100,300 and 500 Lb.containers. Weight 10 Lbs.per gal. Coverage 55 sq.ft., 1/4" thk.wet,per 100 Lbs.

14. Insulkote
Dow Stock Code No.
Austin 5658 Code No.30592
Supplied by Johns-Manville in 50,150 and 500 Lb.containers. Weight 10 Lbs. per gal. Coverage 55 sq.ft.1/4" thk. wet,per 100 Lbs.

15. Insulmastic
Dow Stock Code No.
Austin 5658 Code No.30590
Supplied by Armstrong Cork Co.in 50, 300 and 500 Lb.containers. Weight 10 Lbs.per gal.Coverage 55 sq.ft.1/4" thk.wet,per 100 Lbs.

ADHESIVES CEMENTS

20. No.340 Cement
Dow Stock Code No.200260
Austin 5658 Code No.30013
For cementing joints in Styrofoam and cork. Supplied by Armstrong Cork Co.in 1 and 5 gal.cans. Weight 12½ Lbs.per gal. Coverage 30 sq.ft.per.gal., trowel application.

21. No.EC-921 Cement
Dow Stock Code No.
Austin 5658 Code No.30014
For cementing joints in Styrofoam. Supplied by Minnesota Mining & Mfg.Co., in 1 and 5 gal.cans.Weight 8 Lbs.per gal.Coverage 20 sq.ft.1/16" thk.per gal. trowel application.

22. Trimedge Plastic Tile Cement
Dow Stock Code No.
Austin 5658 Code No.30015
For cementing joints in Styrofoam. Supplied by Trimedge Industries in 1 and 5 gal.cans.Weight 8 Lbs.per gal. Coverage 25 sq.ft. 1/16" thk., trowel application.

23. Plastic Klastigum
Dow Stock Code No.300114
Austin 5658 Code No.30016
For applying hair felt and sealing laps of Weatherproof Felt. Supplied by Barrett in 10,50 and 500 Lb.containers.Weight 10 Lbs.per gal.Coverage 100 sq.ft.1/16" thk.per 35-40 Lbs.

24. No.299 Cork Waterproof Cement
Dow Stock Code No.
Austin 5658 Code No.30033
For cementing cork joints together. Coat only one face of adjoining surfaces. Acid and alkali resistant, waterproof and quick setting.Furnished by Armstrong Cork Co., coverage 35 sq.ft.of joint areas per gal.

WATERPROOF FELT — For Weatherproof Finish

30. J-M Armor Felt
Dow Stock Code No.200286
Austin 5658 Code No.30135
Supplied by Johns-Manville in 65 Lb. rolls 32" wide x 40 ft.long.Coverage 100 sq.ft.per roll.Order white side out,rolls in one piece,felts only.Also known as "Black & White" felt.

MADE: S.P.F.	THE DOW CHEMICAL COMPANY, MIDLAND, MICH.	INSULATION STANDARDS
CHECKED: [illegible]	INSULATION SUNDRIES	
APP'D: [illegible]		IN-203-2
DATE 3-10-50	REVISION DATE: 12-8-52	DOW 00137

MISCELLANEOUS

35. Banding,Steel,Galvanized

Dow Stock Code No.230205
Austin 5658 Code No.30003

For fastening large piping and equipment insulation. Size 25 ga.5/8"x.020" thk.,galvanized,in 100 Lb.rolls equal to 2300 ft. Use Acme Steel Co. or approved equal.Fasten with seals. See item 46.

36. Banding,Steel,Blk.Painted

Dow Stock Code No.230201
Austin 5658 Code No.30006

Same as above except not galvanized and painted black.To be used where it will be overlaid with insulating cements or asphalt mastic for protection against corrosion.(Acme Steel Co. or approved equal)

37. Cork Granulated

Dow Stock Code No.200269
Austin 5658 Code No.30049

For filling voids around cork fitting and valve covers.Regranulated scrap cork supplied from Dow Stock in 50 Lb. bags. Also supplied by Armstrong Cork Co.,their size No.8/14 mesh in 35 Lb. bags. Weight 8 Lbs.per cu.ft.

38. Filler, Seam Cork

Dow Stock Code No.
Austin 5658 Code No.30143

For filling and pointing cork joints. Supplied by Armstrong Cork Co.in 1 and 5 gal.cans. Weight 13½ Lbs.per gal. (An alternate material is asphalt mastic mixed with cork dust) See IN-204.

39. Chalk Line
Dow Stock Code No.10006
Austin 5658 Code No.30863

For tying hair felt insulation. Supplied in 100 ft.rolls.

40. Muslin, 4 oz.

For covering insulation. Order unbleached. Furnished in bolts and rolls 36" wide, in varying lengths as required.

41. Muslin,6 oz.
Dow Stock Code No.
Austin 5658 Code No.30867

Same as No.40. Furnished in bolts and rolls 36" wide,in varying lengths as required.

42. Netting,Hex Mesh Wire

Dow Stock Code No.200254
Austin 5658 Code No.30870

Used as a base for insulating cements and/or asphalt mastic. Order20 ga.1" hex mesh,"galvanized after weaving". Furnished 48" wide x 150 ft.rolls. Also known as poultry netting.

43. Paraffin Wax

Dow Stock Code No.
Austin 5658 Code No.30882

Known as White Crude Scale Wax with melting point of 125°F.Furnished in 100 Lb.net cartons.(Kalamazoo Paraffin Co.)

MADE: S.P.F.	THE DOW CHEMICAL COMPANY, MIDLAND, MICH.	INSULATION STANDARDS
CHECKED: W.A.J.	INSULATION SUNDRIES	
APP'D: G.R.M.		IN-203-3
DATE 3-10-50	REVISION DATE: 12-4-51 DOW 00138	

MISCELLANEOUS continued

44.	Parolite Dow Stock Code No. Austin 5658 Code No.30884	For cementing Styrofoam to equipment. Melting point 125°F. Supplied by Standard Oil of Indiana in 100 Lb. cartons. Wt.56 p.c.f. coverage, 60 Lbs. per 100 sq.ft. of surface coated.
45.	Paste, Cold Water Dow Stock Code No.200262 Austin 5658 Code No.30878	For pasting muslin over insulation. Also called "Dry Paste". Supplied by Jennison Hardware Co. in 100 Lb. bags under trade name "Red Stove Wheat Paste
46.	Seals, Fastening (Clips) Dow Stock Code No.011012 Austin 5658 Code No.30035	For fastening steel banding. Use Acme Steel Co. open type No.81, or approved equal. Supplied in lots of 2.5 and 10 M pcs.
47.	Screws, Sheet Metal Dow Stock Code No.10037 Austin 5658 Code No.40279	For fastening 28 ga. sheet metal. Use size No.7 x ½", RH, Parker-Kalon or approved equal. Supplied in boxes of 1 gross. Use 7/64" drill.
48.	Silicate, Sodium Dow Stock Code No.300209 Austin 5658 Code No.30899	Use 40 Baumé type . Supplied in 50 gallon drums.
49.	Skewers, Wood Dow Stock Code No. Austin 5658 Code No.30890 30891 30892	Supplied by Armstrong Cork Co. (also available from butcher supply companies) Sizes in 1M pcs: ¼" x 4" Wt. 5 Lbs. per M. ¼" x 5½" Wt.6.5 Lbs. per M. ¼" x 7" Wt.10 Lbs. per M.
50.	Staples, Copper-clad Dow Stock Code No.200258 Austin 5658 Code No.30897	Size ¾"x 1", 208 pcs.per Lb.Supplied in 100 Lb.kegs.(Jennison Hardware Co.)
51.	Staples, Copper-clad Dow Stock Code No.200259 Austin 5658 Code No.30898	Size 1" x 1½", 140 pcs.per Lb. Supplied in 100 Lb.kegs (Jennison Hardware Co.)
52.	Styrofoam, Granulated Dow Stock Code No. Austin 5658 Code No.30905	Manufactured by Dow and stocked in No. 6-433 Bldg. Order Grind A type. Supplied in 10 cu.ft.boxes weighing 22 Lbs
53.	Tape, Masking Dow Stock Code No.031401 Austin 5658 Code No.30917 No.30918.	For fastening sectional Styrofoam insulation. Size 1" wide. Supplied by Minnesota Mining & Mfg.Co. "Wetordry No.250" brand, or by Industrial Tape Co., "Permacel No.77" brand.

MADE: S.D.F.	THE DOW CHEMICAL COMPANY, MIDLAND, MICH.	INSULATION STANDARDS
CHECKED: W.A.T.	INSULATION SUNDRIES	IN-203-4
APP'D: W.P.H.		
DATE 3-10-50	REVISION DATE: 12-8-52	DOW 00139

MISCELLANEOUS continued

54. Tape, Asbestos

Dow Stock Code No.020101
Austin 5658 Code No.30910 Size 1" x .020" thk.
30911 Size 1" x .125" thk.

55. Wire, Copper-clad, No.14 Ga. Order soft annealed. Weight 1.71 Lbs. per 100 ft. Supplied in 100 Lb. rolls Use Copper-weld Steel Co.,or approved equal.

Dow Stock Code No.
Austin 5658 Code No.30940

56. Wire, Copper-clad No.12 Ga. Order soft annealed. Weight 1.83 Lbs. per 100 ft. Supplied in 100 Lb.rolls. Use Copper-weld Steel Co.,or approved equal.

Dow Stock Code No.
Austin 5658 Code No.30945

57. Wire, Iron No.12 Ga.Blk. Order soft annealed. Weight 2.91 Lbs. per 100 ft. Supplied in 100 Lb.rolls

Dow Stock Code No.041009
Austin 5658 Code No.41152

58. Wire,Iron,No.16 Ga.Blk. Order soft annealed. Weight 1.04 Lbs. per 100 ft. Supplied in 100 Lb. rolls

Dow Stock Code No.041804
Austin 5658 Code No.41151

59. Wire,Iron,No.9 Ga.Blk. Order soft annealed. Weight 5.78 Lbs. per 100 ft. Supplied in 100 Lb. rolls

Dow Stock Code No.040613
Austin 5658 Code No. 41150

60. Wire, Bare Copper,No.9 Ga. Order soft annealed. Weight 25.23 ft. per pound.

Dow Stock Code No.200277
Austin 5658 Code No.30951

MADE: S.P.F.	THE DOW CHEMICAL COMPANY, MIDLAND, MICH.	INSULATION STANDARDS
CHECKED: Walk	INSULATION SUNDRIES	
APP'D: GPM		IN-203-5
DATE 3-10-50	REVISION DATE: 12-9-52	

INSULATING, WEATHERPROOF and ADHESIVE CEMENTS

- MISCELLANEOUS -

Hard Finish Cement

For use in indoor finish on flanged valves and ells, weld-end valves, size 8" and larger, and all flanged unions and equipment.

FORMULA; Mixture shall consist of three (3) parts of asbestos cement and one (1) part Portland cement by volume. (Note; Brick mortar cement may be used in place of Portland when a slower setting mixture is desired).

Sodium Silicate Asbestos Cement

For use in cementing 85% Magnesia and similar insulating materials to curved and irregular metal surfaces prior to fastening with wire or bands.

FORMULA; This cement is made by sifting asbestos cement into sodium silicate, 3R degree Baume', and mixing to the desired consistency.

Plastic Elastigum

A waterproof plastic asphalt cement for special use in hair-felt application as a vapor barrier and adhesive. For further data refer to Sundries. Coverage is 35 Lbs. per 100 sq.ft. per $^{1}/_{16}$" thk.

Cork Waterproof Cement

A quick-setting cement for cork joints, and resistant to acids and alkalies. Coverage for joints is 35 sq.ft. per gal. For further data refer to Sundries.

Cork Seam Filler

A waterproof mastic filler for cork joints and cracks. It is generally furnished with cork purchases. For further information refer to Sundries.

Asphalt Mastic-Ground Cork Joint Filler

A waterproof mastic filler for cork joints and cracks. It is made by mixing ground cork, mesh size No.8/16*, with sufficient asphalt mastic cement to a stiff plastic consistency, i.e., where the mixture will just trowel without balling.

* If this size ground cork is not available, use granulated cork sifted thru ordinary insect screening.

Rev. 7-21-51

MADE: S.P.F.	THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN	INSULATION STANDARDS
CHECKED: W.R.B.	GENERAL PLANT STANDARDS	
APPD: [illegible]	INSULATING, WEATHERPROOF and ADHESIVE CEMENT SELECTION TABLE	IN-204-2
DATE: 7-15-49		

ST0000346

INSULATING, WEATHERPROOF and ADHESIVE CEMENT SELECTION TABLE

Manufacturer	Trade Name	Temp. Deg.F.	Coverage Sq.ft./100 Lb/1"	Coverage Sq.ft./Bg./1"	Pounds per bag
MINERAL WOOL CEMENT					
Forty-Eight Insulations, Inc.	"48"	1800	50	25	50
Eagle Picher Co.	Super "66"	1800	50	25	50
Philip Carey Mfg.Co.	MW No.50	1800	50	25	50
Balawin-Hill	B-H No.1	1800	50	25	50
For use in direct application to hot metal surfaces, both large & small areas; Valves, fittings and irregular shapes; pointing joints and cracks, and for first coat work. This material is reusable when not exposed to temperatures over 1200° F.					
85% MAGNESIA CEMENT					
Dow Chemical Co.	85% Magnesia	600	58	29	50
Johns-Manville	"	600	58	35	60
Philip Carey Mfg.Co.	"	600	58	35	60
For use in first coat work on large and small areas; on valves, fittings and irregular shapes; pointing joints and cracks. It is not desirable as a finish cement nor for use in hard finish cement.					
ASBESTOS CEMENT					
Johns-Manville	No.352	1000	19	19	100
Armstrong Cork Co.	No.152	1000	19	19	100
Philip Carey Mfg.Co.	No.303 or 7M	1000	19	19	100
For use in general finishing on small and large areas., in hard finish cement and for first coat preceding hard finish cement.					
WEATHERPROOF ASPHALT MASTIC					
		Sq.ft./100 Lb/1/2"	Sq.ft./Gal/1/2"	Gals/Cont.	
Philip Carey Mfg.Co.	Thermotex	55	5.5	5.10 & 50	
Johns-Manville	Insulkote	55	5.5	5.15 & 50	
Armstrong Cork Co.	Insulmastic	50	5.0	5.30 & 50	
For use in Weatherproof Finish on large and small areas. Note: These materials become damaged on freezing and, accordingly, shall be protected both in application and storage.					
ADHESIVE WATERPROOF CEMENT					
		Sq.ft/gal/1/16"	Gals./Cont.		
Armstrong Cork Co.	No.340	30	1 & 5		
Minn.Mining & Mfg.Co.	No.EC-921	25	1 & 5		
Trimedge Industries	Plastic Tile Cement	25	1 & 5		
For use in cementing Styrofoam joints and Styrofoam and cork to metal, concrete, plaster and wood surfaces.					

Rev.7-21-51

MADE: S.P.F.	THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN	INSULATION STANDARDS
CHECKED: W.R.S.	GENERAL PLANT STANDARDS, INSULATING, WEATHERPROOF AND ADHESIVE CEMENT SELECTION TABLE	IN-204-1
APP'D: W.M.		
DATE: 7-15-49	DOW 00142	

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