

FILE NAME: WR Grace (WRG)

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DOCUMENT DESCRIPTION: 1973 MK workshop lecture

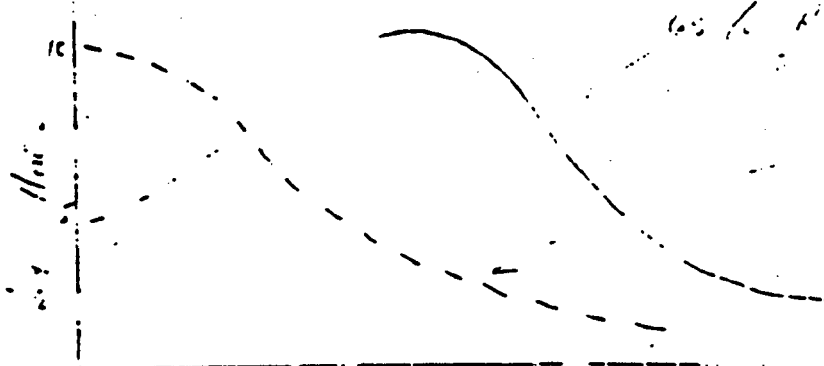
Paul Cornberg - research - purpose of mtg. - learn about MK-5; also to learn about MK in general; to solve problems in field instantly; patent situation not clear on MK-5; will not tell us what the substitute for asbestos is; April '71 - began working on MK-5; committed \$500,000 - and about 12-15 research people; 6-9,000/test at UL and about 9 mos. 4" x 12" furnace @ Cambridge - 4' x 4' at TR - made 120 sample panels; 8' x 6' deck @ USG and Ohio State; went to UL Feb. '72 w/2 materials May we tested MK-5; deck fireproofing can't be too hard - due to expansion of the steel;

Ivan Odler

function - filler and to provide low density for MK; elasticity - important during the pumping; also during fire test - MK is bent by steel; plaster of paris - for the binder; Gypsum setting - plaster of paris - partly soluble in water - fast set - possible in presence of external particles - eg. - dirty equip.



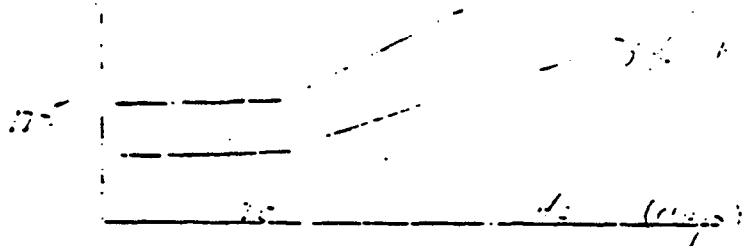
Gypsum
only



Use it quickly; depends on humidity - 30 days in Ea. Region - About 90 days in W. Coast; submit sample - for testing (if stored in trailer) ck - mix in cup - stirring of mixer promotes set time (mix by hand is easiest way to mix MK). Massive crystallization -60-65° Heat generated - will get harder 1# MK - +2# H₂O

Gypsum is calcined - H_2O taken out; (retarders and accelerators) built in to MK to stabilize -

Free water - RH of ambient air + moving of air - important



When MK is heated - results in loss of strength - MK is decomposed.
MK is unhydrated

21% H_2O is lost in fire test

Gypsum sticks well - (MK must be low density - we must entrain air in system) we use air entraining agent - to get density lower - air bubbles are formed - evenly distributed - throughout - bubbles are negatively charged which results in even distribution;

Strength - (tensile strength - resists to pulling) we need high tensile strength during attack of fire - most important; steel used in concrete to increase tensile strength; asbestos - was originally used - replacement is not identical to asbestos - (it is better than MK-3)

- Supersat. state - (longer mix time decreases set time) run - MK thru 3 min. mix - 3 hr. set + thru nozzle - 50 min. - more gases to solution - Di-Hydrate (solution) (Dirty or set MK speeds up set)

squirt around edge of mixer or sides of mixes; wide spatula - blade to clean off sides; (Calcium Sulfate - Di Hydrate) will set off - flush out hoses and save water for re-using; - will set off fast set; wet bags - will set off fast set; retarder used in clean-up and at beginning of day; wet MK or dirty equip. - will not be helped by

Mixing and Proper Mix Consistency - Rosenberg

12 ft.³ - Mixer - 40 RPM - quick fill - frown on guy who uses nose; good close fitting blades; make sure mixer clean - flush thru w/ a sponge; flush w/ retarder in morning; 1.) water 1st 2.) break open bags - keep dust down - some will say - it looks like feathers - introduce it as looking like feathers; pumps better

How much water - 9.5 - 13.5 gallons water - MK-3 more demanding for water than MK-4 or MK-5; 11-11-1/2 gallons - ideal; MK-3 mixed 5 mm. MK-4, MK-5 - mix for 2 minutes; (pumpability and hanging - depends on mix; (Density - dry mixing is critical for MK-4, MK-5; we are controlling the density) Mixer density is what to look for when problems occur; Pancake batter - good; run finger down thru - makes wake which slowly closes; this is good - if closes immed. - or doesn't close - not right; 48-50 lbs. ft.³ - ideal mixer density; low density looked at good - yields - not good for pumping; lighter because - more of a problem in pumping - ck. density - probably too low - (piston pushes ball 1300 PSI - more back pressure - will get away on low rise

When cleaning - out - must reduce pumping speed; overwatering leads to low yields - (62.4 lbs./ft.³ water) - not true

Overwatering - disaster in spraying; dryer mix - better it hangs; Painted surface - not as easy as spraying regular steel; tendency is for water to be repelled - should be paint mfr. responsibility to give data about paint being an integral part of fireproofing system. Cheaper to shop coat steel in factory than to clean up mill scale - we don't have tests at UL showing painted steel; (if it doesn't say paint - then we shouldn't advise) bond strength

Negotiations now w/ - Organic materials burn at 3-400°
E-119 goes to 2000° - MK doesn't burn - in between we slip an organic material - paint - flakes off - (what happens to MK)

Small granular rusting - doesn't hurt; loose mill scale bad - N.Y. - air blasting - 90% of jobs - not shop coated; nobody knows whether MK will fail - (columns - beams get painted 2-3 yrs. - should be shop coated; don't get in a position of guaranteeing the paint - decks are being tested now; and decks are being painted now; things are unclear - Oxygen source needed for paint - to burn; (Weathering - type steel we are not talking about) Cost not that much more 2-3¢/lb.;

- Pumping - hanging - slides - yields - can be traced to mixes; MK-5 has dryer feel (don't add more water) - tendency will be to overwater; if we overwater - we will experience slides; - water will bleed out
- of MK to back of steel - reason looks dry (reinforcing fiber - will see lumps - will interpret as lumps of MK; 2-3 min. can easily go by; then complains about pumpability - put water in - then material -

5 min. - too long
on MK-3
48# at 5 min;
52-48 - takes long
time - can mix 10 mi

MK-4, MK-5 - to 3 mi
we are too long
1-1/2 - 2 min. - tur
off mixer

48# - MK-4
MK-5 better pumping
acceptable at 4 min.

46

2 min. - dens. MK-5 is 50# - MK-4 is 52# at 2 minutes; Turn off mixer;
don't go below 48# for MK-4 - don't go below 40 - for MK-5;
Density is important - more than mix-time; figures at 40 RPM

too little density
results in poor
pumping.

think of MK as sponge pillow - must have water - 50# dens.

54

MK-3 takes lots
more water;
graph shows
this relation

55

56

water + air bubbles make for fluidity; - too much water fluidity - won't hang; air bubbles will be broken due to air pressure

MK-5 won't look runny- like MK-3; (47# bag) within 2-6 mos. - we will standardize weights - and will eventually standardize the water.

Hard to accurately put in 7 full buckets (1/4" off on buckets - result in bad MK) Quick fill - are too slow (doesn't fill up in time) might need larger hose.

30 secs. for quick fill tank to empty; automatic float valves - slowly close; water gage - anything that measures height of tank; we have problems measuring.

Mono-Kote - Cracking

25¢/ft.² - to go back and correct problem - 3 types; mud or map cracking dry river bed This is most serious crack .

Why does this happen? Fine particles - stick together - attract one another law of physics; water evaporates from mud sample; water leaves - particles draw closer together - whole mass loses volume - grows smaller; surface tension phenomenon - actually shrinks.

Differential shrinkage: adhesive force - holds sample - 2 phen. adhesive force keeps MK stuck to steel; water leaves top before bottom and cracks.

Gyp. sets - forms crystals - which attach to each other; gypsum

Evap. - leads to tendency to crack (air voids left by evaporating)

Strength of gypsum resists tendency to crack; if MK not up to strength then shrinkage will win out; evap. - cause cohesiveness of mass; Crystals act as reinforcing steel (steel binder resists cracking)

Why cracking - set up MK - or dirty MK -

set takes place in line - set already occurred - broke up crystals as you spray; lost strength - will crack

Old MK - no binder; improperly made binder; could be a cause;
(pre-hydrated material) - causes cracks - no binder

Wash slow down - leaves mixer running; Retarders - could cause
cracking - 8-10 hrs. - 90° - 0 RH 40 MPH - L.A. area - could dry in
2 hrs.

Unusual delays - (high water ratio)

6" MK in corner

Corner Cracking

MK-5 tendency to crack will be less; but MK not designed to handle
that much stress - Won't have an effect on the fire rating - (binders
not that strong)

Poor Ventilation

MK remains wet 90° RH; never dries; strength gain depends on good
drying

Gypsum - (few big crystals instead of lots of small ones)

Use fresh MK - good ventilation - put up quickly - to avoid problems:

Prolonged Cracking - Wet Conditions

What about #3 vs. #4 agg.; Cracking has no bearing on change in

• aggregates - UL fire tests on both aggregates; No change in yields;

(Amt. of water - depends on surface area) - poorly expanded are?

Does this cause any problems- less water will be absorbed - most of
water is located between spaces of aggregates; Not dependent on
changes in aggregates; pumping is dependent on density;

Retarders

eggs, glues, gelatin, case in (milk) orange juice, tea

Accelerators

gypsum, cement, table salt, sodium silicate;

retarders - coat the crystals which stops growth;

(have - spacings which link together molecules) hasten

(U.S.G. - retarder) - we don't charge for it.

Red top: - (Gold Seal - National Gypsum).

Karenberg - Pumps

MK-5 - back pressure less -

Mayno - Thompson - Essich - 3 types of pumps

Moyno - is small - rarely used; plug to wall

Essich - good for hi rise bldgs. (Never say Thompson is bad pump)

Stator - squeezes MK - direct draw - no back pressure - will pump low density material

Th. - 12 cyl. mach. - piston pump; good to 30 floors - 300 bags/day
7 hr. day

Essich + 1000# Mixer 12 ft.³ TM 30 pump var. speed pump speeds 40 to 140 strokes/min. - 70-90 strokes/min.

look at piston shaft - (oiler) count strokes - (pump RPM) only -

150-250 bags 7 hr. day 350-400 bags

(48-50 MK-4,3) (46#/ft.³ - MK-5) densities

deliv. rate - (can increase deliv. rate by increasing water)

1 coat - spray man 150 bags - 1.8 water ratio - dense mat. no overspray.

GlenBros--soup - less than 1/2" 2 coats over 300 bags/day

*White balls distort - (black neoprene ball rips apart)

seats tear up ball; (K-ball) lasts 4 hrs. on Glen Bros. job w/1000#

back pressure

steel balls - rip apart seat 90 RPM - 150 bags/day MK-4

can MK-5 - rate up to 300 bags/day

balls deformation or cracked Check Valve

Orifice size - 5/8" don't work w/MK-5 OK w/ MK-4

uneven application - go to 1/2" orifice

(Air pressure over 20 PSI hurts air)

not stripping out the air - w/ 15-20 PSI -

Auxiliary Compressor

Summary

- 1) dirty equip. acc. set - nozz. clog. - hi pump press.
clean ea. day
- 2) poor stor. acc. set - cracking dry MK
use bags in 1 mo.
- 3) insuff. mix low yr. hi dens. plug due to lump
- 4) overmix slow pump - low dens. - use clutch on
mixer to stop mixer
- 5) cold temp. 40°-45° - acc. set - slides drop
port. heaters - tarps
- 6) hi temp. above 95° retarded set
don't add more retarder
- 7) hi humidity inadequate vent

Sodium Propionate

too much water slow crack shrink - stiffer mix - large mix time
too hi pressure at overspray - rebounding low yield
nozzle

need right orifice -

stream - poor pattern

Pump malfunction

slow pump

Check ball valves

avoid air plugs

Undersized riser

hi press. in pump

piping

blowouts in pump - fast wear

Use larger piping

tapered reducers - radius elbows

leaky connect.

plug

dirty steel

slides fall out - clean steel - remove oil, peel
patch

dirty water

accelerator set - use clean water

(set MK - spray)

crack - fall off

no set - demand water

Waste the material. Keep mixes clean.

(Meet at 7:00 in lot) General Session:

MK - Manual? (job procedure - set up and estimating)

Most contractors don't take yield checks; take typical bag - sale - scale - 28-32 bd. ft./ bag - check jobs - on floor basis - breakdown on estimate per floor 20% waste factor 30 bd. ft. (25-27 bd. ft.)

300 bags/day - sacrifice yields

Doyle Nigh - 175 bags per day

beams vs. deck and beams one nozzle some days 240-250

15 horse - 150-160 bags/day secret of volume productions -

is no down time; 5 min. batch - 36 bags per hour - 252 bags/day

(315 bags/day - 4 min. mix) 3 man crew from scaffold; (Fla. - 4 man crew - 180 bags) (6 hrs. - work out of 8 hr. day) (push hard on open floors to average 175)

Br. Columbia - 150 bags/day is a good day - with 3 man crew - starts early - mixer - shut down for lunch - wash up early;

What @ mechanical contractor getting there early - L.A. no

What about clean-up - 1/2 - 1c/bd. ft. for cleanup - 15c/bag for cleanup \$95/day - spray man \$90 - hod carrier

cleanup results in 1 extra man per day - in Ea. Region

Patching - w/MK vs. cost of patching of fibers - MK w/ trowel is cheaper - but if we have to bring back in equipment - we are more expensive - GC's in N.Y.C. are getting lump sum prices - some leave bags behind; L.A. general - would rather do himself

cleanup on floors - (wire scrape them - L.Z.) Canada broom cleans drywall - knife blade; made wider to cut off floor -

Painted - Paint Mfgs. - selling str. to paint beams, coils;
hand 1/4" (dirty the steel) then come back; UL beams are tested
unpainted=

sheet of MK - keeps oxygen away from steel
(linseed oil base paint) after two weeks drying - no difference about
bond but watch out about spraying before 2 weeks dry
(Chicago - can hang 1-1/4" on beams - even on edge of beams)

Surface Hardness

Hard-hi density - usable for exterior applications - (smoke generation -
re: albi-clad-)
re: (overspray - in hi speed elevator shafts) - PVC

Cast

\$200/ton 80 bags per day - price is delivered to the job
\$212/Ton - 75 bags/day
(90-100 bags per day)

Detail Description

Index	PHASES I, II and III	Estimated Hours	Rate/Hours	Total Estimated Cost Dollars
<u>Washington Research Center</u>				
	Chief Investigator (E.W. Lard)	920		
	Senior Scientist (E.E. Stahly)	720		
	Senior Chemist (R. W. Murch)	110		
	Chemists	550		
	Analytical Chemist	350		
	Project Coordinator (R.J. Rice)	180		
	Technicians	3240		
	Provision for Salary Increases			
<u>Seattle Div.</u>				
	Director R&D (H. I. Freeman)	156		
	Chemical Engineer (R. Hurts)	1040		
	Technicians	1040		
Total Direct Labor - Total hrs		(2) 8656		8-6,--5

3. Other
 1. Shopwork Orders

Total Direct	<u>\$18,550</u>
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II. Indirect Costs

2. Overhead (2500 x \$16,6-1) **	<u>\$41,662</u>
Subtotal	<u>\$60,212</u>
b. 2500 (2500 x 10,155) **	<u>\$25,388</u>
Total Cost	<u>\$85,600</u>

III. Fee (3%)

Total Cost & Fee (8500)	<u>\$90,475</u>
-------------------------	-----------------

These are Gross Hours. Net hours are 2700. Difference of 250 hours are for Vacations, Holidays, Sickness, etc.
 **Overhead & CMA Rates are Provisional Rates, subject to audit determination.

U. S. DEPARTMENT OF AGRICULTURE
BUREAU OF ENTOMOLOGY

WASH. D. C. 20250

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RESEARCH

Direct Cost	Hours	Rate	Amount
Personnel			
Classification			

Principal Investigator (part)	400		
Senior Scientist (Salary)	300		
Senior Chemist (part)	200		
Chemists	350		
Analytical Chemist	175		
Project Coordinator (rice)	60		

Total Professional	1485		
Technicians	1500		

Totals	2985		326,001
by Exception for Salary Increase			610

- a. Salaries
- b. Materials
- c. Travel
- 1. Transportation
- 2. Substances

310,611
1,000

W. B. Grace & Co.
Research Division

NASA/M30 Nonflammable Ratings

Estimated
Cost
PAGE II

I. Direct Cost

Manpower

<u>Classification</u>	<u>Hours</u>	<u>Rate</u>	<u>Amount</u>
Principal Investigator (Lari)	401	\$	
Senior Scientist (Stahly)	300		
Senior Chemist (Church)	200		
Chemists	160		
Analytical Chemist	175		
Project Coordinator (Rice)	60		

Total Professional
Technicians

1295
1500

Totals

2795*

\$14,705

4% Provision For Salary Increase

588

a. Salaries

\$ 15,293

b. Materials

1,500

c. Travel

1. Transportation
2. Subsistence

376
250

626

d. Other

1. Shopwork Orders

200

Total Direct

\$ 17,619

II. Indirect Costs

a. Overhead (130% x \$15,293) **

19,881

Subtotal

\$ 37,500

b. G&A (14% x \$37,500) **

5,250

Total Cost

\$ 42,750

III. Fee (8%)

Total Cost & Fee (WRC)

3,420

\$ 46,170

*These are Gross hours. Net hours are 2553. Difference of 242 hours are for Vacations, Holidays, Sickness, etc.

**Overhead & G&A Rates are Provisional Rates, subject to audit determination.

W. R. Grace & Co.
Research Division

NASA, MSC Nonflammable Containings

Estimated
Cost
Phase II

I. Direct Cost

Manpower

Classification	Hours	Rate	Amount
Principal Investigator (Lard)	120		
Senior Scientist (Stahly)	120		
Senior Chemist (Church)	40		
Chemists	40		
Analytical Chemist	-		
Project Coordinator (Rice)	60		
Total Professional	380		
Technicians	240		
Totals	620 *		3,857
4% Provision For Salary Increase			154

a. Salaries		\$ 4,011
b. Materials		100
c. Travel		
1. Transportation	556	
2. Subsistence	300	
		856
d. Other		
1. Shopwork Orders		100
Total Direct		\$ 5,367

II. Indirect Costs

a. Overhead (130% x \$ 4,011)**	5,214
Subtotal	\$ 10,581
b. G&A (24% x \$ 10,581)**	1,481
Total Cost	\$ 12,062

III. Fee (6%)

Total Cost & Fee (WRC)	965
	\$ 13,027

*These are Gross hours. Net hours are 566. Difference of 54 hours are for Vacations, Holidays, Sickness, etc.

**Overhead & G&A Rates are Provisional Rates, subject to audit determination.

Mr. E. J. Connelley, Jr.
 Director, Division
 of Research, U.S.
 Department of Energy

WASHINGTON, D.C. 20545

2001-10-10
 Cost
 2001-10-10

2001-10-10

Direct Costs
 Transport
 Classification

Director of Research
 Chemical Engineers
 Technicians

2236+

1040
 1040
 156

a. Salaries
 b. Materials
 c. Travel

1. Transportation
 2. Subistence

d. Other

1. Shopwork Index

Total Direct

200
 200

275

200
 75

10,500
 1,000

1. Indirect Costs

a. Overhead (1100 x 210,500) =

11,550

Sub-total

11,550

b. GSA (1100 x 223,525) =

245,877

Total Cost

245,877

III. Fee (8%)

Total Cost & Fee

264,547

2,275

266,822

These are Gross hours. Net hours are 2042. Difference of 158 hours are for Vacations, Holidays, Sickness, etc.
 **Overhead & GSA Rates are Provisional Rates, subject to audit determination.

Notes for Phases I, II, and III

- (1) Rates are current as of date of proposal.
- (2) These are gross hours. Net hours are 9.50 less because of allowance for sick leave, vacations, etc. - based on past experience.
- (3) Provisional rate, subject to audit determination, but current.
- (4) Past experience on Government contracts for the past six years is that materials run about 10% of direct salaries.
- (5) Shop work orders are special pieces of equipment to be made in our shops. Special units are defined as novel or new test apparatus, reactors, columns, etc. not known at the present time which are not available commercially, and which would be designed by our laboratory personnel. If no such special equipment is required, monies budgeted in this category will not be spent.