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CONSOLIDATED MONTHLY REPORT

JULY 1973

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## MONTHLY REPORT FOR JULY 1973

## CONSOLIDATED EDITION

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MONO-KOTE PRODUCT IMPROVEMENT (Project 2659)

The broad objective of this program is to gain understanding and find the solution to the Mono-Kote shrink-crack problem. Shrinkage and cracking of Mono-Kote are serious field problems remedied at present only by removal and replacement--a costly procedure. Finding the causes and solution(s) to the problems is a major effort of CPD with participation by WRC. Our role has been to determine the fundamental properties of Mono-Kote components (gypsum plaster or ZOU and vermiculite) and their interaction in Mono-Kote mortars. This program is now complete.

Preliminary conclusions follow. Final conclusions will be made basis a statistical analysis by the Mathematical Department.

## I. With ZOU/vermiculite mortars (ZOU/vermiculite + water):

- 1) Flexural strength, generally considered a measure of cracking resistance, is dependent upon vermiculite type and particle size, water level, and drying time. #4 Kearney vermiculite strongest at 85 psi (water/solids 0.95) and 37 psi (w/s 1.15); #3 Libby weakest at 37 psi (w/s 1.40) and 7 psi (w/s 1.70). Maximum strength is attained only after elimination of free water by oven drying or curing at atmospheric conditions.
- 2) Expansion/contraction is relatively small at  $\pm 0.5\%$ . No cracking observed despite wide variations in water level.
- 3) Water demand.

Water demand of vermiculite/ZOU mortar decreases as particle size decreases for constant Vicat at 25 (Vicat is a measure of wet-mortar consistency).

|              | #3 Libby<br>Unattrited | #3 Libby<br>Attrited | #3 Kearney<br>Unattrited | #3 Kearney<br>Attrited |
|--------------|------------------------|----------------------|--------------------------|------------------------|
| Water/Solids | 1.55                   | 1.32                 | 1.23                     | 1.09                   |

## II. With MK-IV Formulations:

- 1) Expansion/contraction less in MK-IV than ZOU/vermiculite mortars. Maximum MK-IV shrinkage  $-0.12\%$ ; zero expansion.
- 2) Maryland (Nova Scotia) and Gypsum, Ohio ZOU's (both US Gypsum) gave evidence of cracking in MK-IV. These were short micro cracks. California and Iowa ZOU's (both National Gypsum) showed no evidence of cracking, micro or otherwise.

- 3) There is no evidence to show shrinkage in (1) is related to cracking described in (2).

Statistical analysis of data in progress; when finished, a final report will be prepared.

Recommendations and new Mono-Kote program will be submitted to CPD for approval.

(Kraus, Kolbe, Legal)

#### IMPROVED VERMICULITE EXPANSION

The following two projects have a common goal of improving the yield of finished vermiculite product from vermiculite ore. The approach on Project 2682 is to improve expansion by chemical treatment of the ore; while Project 2684 is attempting to improve the thermal efficiency of the expansion process.

#### CHEMICAL TREATMENT OF VERMICULITE ORE (Project 2682)

Experimental work, at both WRC and Kearney, South Carolina, has shown that chemical treatment of Allen vermiculite ore will improve expansion characteristics, thus improving yield and subsequently plant throughput. Last month, it was described that Allen ore Group 3, a marginal product, could be upgraded to perform in a manner similar to standard Waldrep by treatment with 20% diammonium phosphate solution. This has the effect of increasing the yield about 20 bags per ton, or about 45%.

No substantial experimental work has been conducted this month. We are awaiting the results of an economic analysis being made by CPD, Cambridge, who have been advised of the results. Preliminary calculations by Hartwig (Process Development) show that profitability can be increased significantly but actual numbers, of course, depend upon factors of which we are not aware. Our calculations based on information from CPD on the vermiculite ore reserves at Kearney show that reserves can be effectively increased by a factor of 74%. This calculation is made on the basis that the reserves exist in a ratio of 50% marginal Allen and 50% standard Waldrep. Presently, the reserves are being used in the ratio of 15-85. If the treatment permitted the ore to be used in the same ratio as in the reserves, i.e., 1:1 instead of the present 1:5.7, this would add 7.4 years to reserves for each ten-year life presently calculated.