

UNION CARBIDE CORPORATION
CHEMICALS AND PLASTICS
ENGINEERING
SOUTH CHARLESTON, WEST VIRGINIA

RECEIVED
DEC 23 1970
R. N. WHEELER

MEMORANDUM

To: Mr. R. O. Cavender

December 21, 1970

Copy to: Dr. R. R. Ashley
Mr. Peter Barna
Mr. A. A. Brown
Mr. Edward Bell
Mr. T. E. Gallagher
Mr. J. W. Greenlee
Mr. J. H. Howell
Mr. R. M. Huckins
Mr. M. E. Eisenhower
Mr. G. R. Kraft
Dr. W. R. Manning
Mr. J. R. Matthews
Mr. W. W. McManus
Mr. P. H. Rohr
Dr. A. B. Steele
Mr. R. H. Steinberg
Mr. C. C. Tanona
Mr. R. N. Wheeler
Mr. C. P. Williams

FILE COPY
DO NOT WRITE

From: C. K. Wood

Subject: Vinyl Chloride Storage Sphere Legs
North Charleston Tank Farm

The CB&I report on the failures which occurred in the legs of the subject sphere during last winter presented a theoretical explanation for the happenings and suggested that corrective action must be taken. I have reviewed this report in detail and consulted with technologists both within and outside the Corporation. Several aspects of the situation can logically be questioned as follows:

1. The petrographic study of the grout cores indicated relatively high or overdose concentration of both lignosulfonate and triethanolamine. Since no admixtures were specified or reported by inspection and since these products are normally used in competitive admixtures, it appears questionable that overdoses of both admixtures would have been used in the same mix.

UCC
024333

2. The phenomenon of continuous grout growth has been recognized for many years with certain special aggregate materials as prime cause, but normal Portland cement and standard aggregate mixtures do not normally support such a situation. The composite column technique of filling pipe with concrete or mortar is a long established one with no previously known problems of this sort.
3. If another similar failure would occur in one of the other sphere legs, we do not feel that the vessel would be in immediate danger and probably would be repaired as before, even without emptying the vessel of its contents.
4. Even if it were decided necessary to attempt to accelerate the evaporation of excess moisture from the in-place grout material as CB&I suggests, a proper procedure to accomplish this would be very difficult and costly. Any heat applied to the legs would have to be uniformly applied to all the legs and very accurately controlled to prevent differential expansion of the legs and accompanying overstress in the shell of the sphere.

Another explanation for these failures might be more logical than that of the grout growth. Reports indicate that the contractor did have difficulty pumping the grout mixture into the small opening provided for this purpose and did have to adjust the mix several times before he succeeded. The final mix could have had excess water and too much retarder. In this condition the mass was protected from evaporation by the steel casing and with cold weather approaching soon after placement, the complete hydration of the cement might not have taken place for several months. The overwatered plastic state of the grout material could have then easily frozen and split the poorly penetrated and brittle weld seams. When the strain gage tests were run in February, the material might still have been partially frozen which would explain the residual stresses found. Since the legs have now gone through a long, hot summer, the cement is surely hydrated and more of the moisture could have evaporated. If this is the case, the problem might have solved itself.

I had duplicate core samples of the grout taken when the CB&I test work was performed, and any of their laboratory work could be duplicated. A strain gage test could be run on another leg to determine if any residual circumferential stress still exists. Strain gages could be mounted on the legs and an attempt made to monitor change in stress. Any or all of these tests could be performed and we would probably learn from their results, but I cannot justify performing any of them at this time.

As indicated earlier, we do not feel that the sphere would be in danger even if another similar leg seam split did occur. Therefore, I recommend that no further action be taken at this time except regular inspection of the legs to watch for any possible changes.

Mr. R. O. Cavender

-3-

December 21, 1970

We plan to develop guide specifications for concrete filled legs to try to prevent similar happening in the future.

I suggest any comments on these conclusions be directed to the writer with a copy to Mr. P. H. Rohr, Vessel Design Group Leader.

C. K. Wood
C. K. Wood
Group Leader
Civil Engineering Technology

CKW:IW

UCC
024335