



H.L.O.

September 5, 1963

MEMORANDUM

Blast Furnace
(Stack linings and inwall cooling)

Referring to Ken Haley's letter dated July 18, 1963.

McKee have given us their comments under date of August 27, 1963 in reply to our questions to them August 1, 1963, on blast furnace shell cooling and the use of high density refractories in blast furnace linings.

We believe these points partially cover Ken Haley's questions both on the cooling and refractory phases.

We have great respect for Mr. Bill Collison and believe his conclusions to be well founded, although further discussion among the Armco furnace people would appear to be in order.


William Fredericks
Blast Furnace and
Coke Plant Engineer

WF:kb
Attachments

cc: W. Dannecker
K. Haley
H. Holiday
D. S. Holstein
N. Kurfiss ✓
E. Marshall
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ARTHUR G. MCKEE & COMPANY
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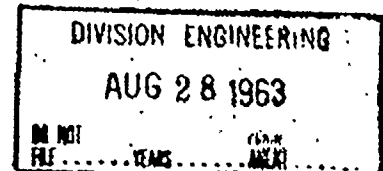
CLEVELAND, OHIO

August 27, 1963

CABLE ADDRESS
MACCO, CLEVELAND

J. F. BAIER
VICE PRESIDENT
ENGINEERING
METALS DIVISION

NEW YORK OFFICE
30 ROCKEFELLER PLAZA
ENGINEERING OFFICE
UNION, NEW JERSEY



Mr. William Fredericks
Blast Furnace and Coke Plant Engineer
Armco Steel Corporation
Middletown, Ohio

Subject: Blast Furnace Cooling - McKee Reference: N-4590

Dear Bill:

With reference to your letter of August 1, 1963 regarding cooling for the blast furnace stacks, we submit the following comments.

McKee has not participated in any investigative work with regard to the relative merits of conventional versus outside shell cooling for the blast furnace stack. All of our installations have used cooling plates set in the brick work with the exception of the Middletown furnace and Hamilton No. 2.

Enclosed are some comments prepared by Bill Collison, formerly Manager of Operations at Zug Island, in which he lists some of the possible advantages and disadvantages using outside cooling. He has also included some notes in connection with the use of mullite and high alumina brick that were obtained from Mr. H. M. Kraner of Bethlehem Steel.

We trust that the above information will be helpful to you and if you have any further questions, please advise.

Yours very truly,

ARTHUR G. MCKEE & COMPANY

J. F. Baier
J. F. Baier

JFB:gtf
Enc.

cc: Mr. B. B. Frost (w/encls.)

Armco - N-4590

Middletown Blast Furnace

Shell Cooling

Although inwall cooling plates are the commonly accepted method of cooling inwalls, shell cooling has certain advantages:

- (1) Full coverage and good rate of heat transfer under favorable conditions. Spray cooling has been used to cool local hot spots in which lining failure had occurred despite inwall cooling plates. (Plates were probably too widely spaced).
- (2) No problems of packing coolers and gas leakage around coolers.
- (3) Sound inwall without interruptions for cooling plates; reduced tendency to leak hot stack gases into space between lining and shell.
- (4) No water leakage into furnace because of cooling plate failure.
- (5) No cooling plates being pulled into furnace because of lining failure. It would seem that lining wear will cause this problem more readily with the thin lining.
- (6) Installation cost is lower. Cooling plates should be closely spaced with thin lining.

Disadvantages:

- (1) Scale formation under some circumstances, reducing heat transfer and upsetting water distribution.
- (2) Difficulty of getting good water distribution with shell irregularities.
- (3) Splash and spray problems, especially with strong winds, and attendant ice problems in freezing weather.
- (4) Total loss of cooling on low water pressure unless a second spray pipe is placed at lower level. Second spray pipe may be desirable to properly cover lower stack.
- (5) Insertion of many "stub" cooling plates in considerable areas of lining failure has provided cooling and anchorage for "wall make-up" and made possible continuation of furnace campaign in several instances.

Mullite and High Alumina Refractories

Test installations of mullite and high alumina brick, both in the area above the mantel and just below stock line armor have been made by Bethlehem. These installations were made with the hope that the abrasion resistance and strength of these materials would justify the increased cost. Spalling and carbon monoxide resistance at the stock line are not expected to significantly be better. Resistance to slag attack and heat at the mantel may be better. In view of attack by volatilized alkali salts in laboratory experiments, there is concern about deterioration due to alkalis. Mr. H. M. Kraner, Associate Director of Research Ceramics, for Bethlehem, supplied this information.

At this time there is no clear justification for the additional cost of mullite or high alumina refractories over super duty brick.

W. H. Collison
8/14/63

August 1, 1963

Mr. Frank Baier, Vice President
A. G. McKee Company
2600 Chester Street
Cleveland, Ohio

Subject: Middletown Blast Furnace

Dear Frank:

The McKee Furnace at Middletown is due for a relining in the next 12 to 18 months. The general lines to be similar to present design incorporating the 18" inwall section, and as you are now building into the Amanda Furnace.

Question is raised as to the efficiency and/or functional advantage of inwall plates versus shell cooling or both, in an effort to prolong lining life, under operating conditions of 100% pellet burdens, with resulting increased upper bosh and lower inwall temperatures.

We would be interested to know if McKee have done any investigative work on temperature isotherms, for heat transmission through brickwork, using conventional plates or shell cooling and what effect this contact cooling might have on the brickwork?

The Amanda Furnace has superduty brick in the upper bosh and lower inwall, with plate coolers, would you consider other types of refractory, say high alumina or mullite to obtain improved refractory life?

We understand Bethlehem are currently using mullite for the first 30' above the mantle and in the lower stock line areas. Would you have information as to their thinking regarding this material over conventional refractories?

Will appreciate your comments.

Very truly yours,

William Fredericks
Blast Furnace and
Coke Plant Engineer

VP:kb

cc: E. R. Maley
W. E. Marshall