

# CASE STUDY:

## Blended Coal

TIVAR® 88 High Performance Lining Solution

### THE CASE IN BRIEF

**Application:** Coal Bunkers

**Quantity:** 56 Discharge Hoppers

**Liner:** TIVAR® 88-2, 1/4" Thick Drop-in Liners

**Bulk Material:** Bituminous Coal, Sub-bituminous Coal Blend

**Substrate:** Stainless Steel

**Problem:** Flow problems, sticking and bridging

**Date Installed:** 1995

## DROP-IN TIVAR® 88-2 LINERS SOLVE COAL BUNKER FLOW PROBLEMS AT COKE PLANT

**Background:** The coal bunkers at a U.S. steel coke plant were originally designed to have an expanded flow pattern, with mass flow occurring in the discharge hoppers and funnel flow occurring in the upper portion of the bin. (An expanded flow pattern results when the mass flow at the top of the discharge hoppers is significant enough to prevent a stable rathole from occurring in the funnel flow portion of the bin.) However, instead of handling bituminous coal - for which the original bunkers were designed - the plant switched to a blended coal comprised of bituminous coal, sub-bituminous coal and petroleum additives. The flow characteristics of this blended coal were different from those of the pure bituminous coal, therefore changing the overall flow pattern in the bunker.



TIVAR® 88-2 fabricated seamless drop-in liners and diverter plate covers.

**Problem:** When the flow characteristics changed, flow did not occur along the walls in the stainless steel hoppers, resulting in severe flow problems within the bunkers that supplied the coke ovens. Stable ratholes developed over the discharge outlets within the bunker, resulting in a reduction in live storage capacity of 50-60%.

**Solution:** Plant engineers at the coke plant contracted the services of a bulk materials flow consultant, who proposed two options. The first option was to modify the design of the coal bunkers by changing the sloping wall angle of the discharge hoppers from 67° to 70°. To do this, however, would have meant complete replacement of, or significant structural modifications to, the discharge hoppers. The second option involved lining the existing hoppers with a low coefficient of friction liner and installing air cannons. Based on a cost comparison of the two options and the downtime required to make structural modifications, the decision was made to pursue the low-friction lining option. Quadrant Engineering Plastic Products was contracted to design a liner installation solution. Quadrant Engineering Plastic Products System TIVAR® Engineering team recommended fabricating seamless drop-in hopper liners and diverter plate covers manufactured from TIVAR® 88-2.

**Results:** Using this solution expedited the lining process and the one-piece, seamless design - eliminating fasteners in the flow stream - significantly increasing the overall performance of the lining system by maximizing the surface integrity of the TIVAR® 88-2 material. Of the 56 TIVAR® 88-2 drop-in liners installed in 1995, none are showing any signs of wear. Approximately 40,000 tons of coal pass through each lined hopper every year and according to the plant project engineering manager, discharge of the coal is 100% and full bin capacity is now being realized. Although air cannons were purchased, they were never installed and have never been needed. The successful use of these liners has enabled the plant to delete one operating turn per day, saving several hundred thousand dollars each year.

Important: Most plastics will ignite and sustain flame under certain conditions. Caution is urged where any material may be exposed to open flame or heat generating equipment. Use Material Safety Data Sheets to determine auto-ignition and flashpoint temperatures of material or consult Quadrant Engineering Plastic Products.

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