

Heat, acid-resistant concrete lasts 15+ years in coke wharf


LOCATION

 Clairton,
Pennsylvania

COMPLETION

1991


OPERATION

Coke mill


PRODUCTS

TUFCEM™ Silicate Concrete

Challenge: A heat and acid resistant material needed to refurbish coke wharf pilasters and corbels with minimal downtime

Solution: TUFCEM Silicate Concrete that lasted over 15 years, and set the standard for future repair projects

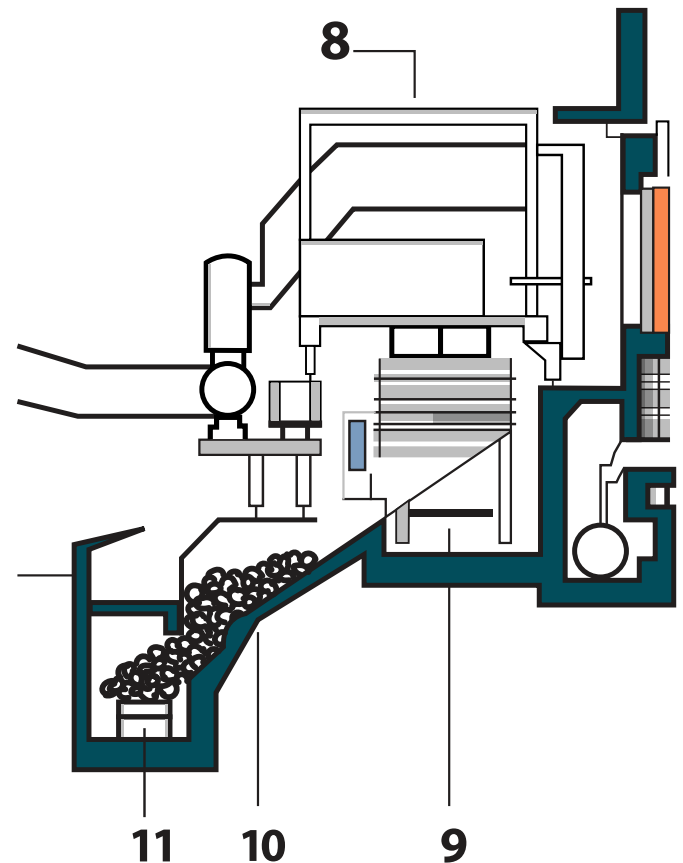
Finding a reliable material of construction for the coke wharf—exposed to mechanical abuse, severe heat, and acidic water and fumes—is a challenge every coking plant faces. The wharf is exposed to mechanical wear and tear from the impact and abrasion of the coke, thermal shock from the hot coke, and corrosive liquid and fumes produced as the coke is quenched.

In 1991, a US Steel coking plant in western Pennsylvania, USA, was searching for a way to refurbish the corroded and spalled Portland cement corbels and pilasters in its coke wharf. The mill consulted with ErgonArmor to explore options.

After assessing the exposure conditions and constructability issues for the wharf renovation, the project team focused its attention on ErgonArmor's TUFCEM Silicate Concrete-Foundation Grade (TSC-FG), a potassium silicate based structural concrete with exceptional heat and acid resistance properties.

ErgonArmor's technical department studied the effects of different types of reinforcing fibers on the structural properties of its TSC-FG. Lab testing indicated that 0.020 inches diameter by 0.75 inches long (0.5mm diameter by 19mm long) 304 stainless steel fibers added to the pre-proportioned concrete mix at a rate of 2% by weight enhanced the material's toughness as well as its compressive and tensile strengths without compromising the product's desirable heat and corrosion resistance.

The installer removed loose material from the corroded and spalled wharf structure and repaired the steel reinforcing bars



1. Coke Wharf Schematic - Hot coke is quenched (9) then dumped onto a sloped shelf (10) before dropping several feet into a transportation or storage facility (11)

where needed. The TSC-FG, which has a work life of about 30 minutes at 70°F (21°C), was mixed on-site.

The stainless steel fibers were added as the material was mixed. The damaged structures were then formed and repoured. A stainless steel plate capped each pilaster and a carbon steel shield protected each corbel from direct coke impact.

In addition to offering the thermal and corrosion protection the coke wharf demanded, TSC-FG offered some favorable handling properties:

- May be mixed and placed using the same tools and equipment as those used for Portland cement concrete
- Cleans up with water while wet, unlike epoxy and vinyl ester polymer concretes
- Reaches 2,000 psi (14 MPa) compressive strength in 24 hours, an attractive feature when downtime must be minimized

After over 15 years of service, TUFCEM Silicate Concrete had out-lived every other refurbishment material tested at the mill and was chosen again for additional renovations undertaken in 2007.



2. Mixing Tufchem Silicate Concrete