SAN FELIPE PLANT

- Built in 1985
- Residential face brick
- Production > 100 MMBE/year
- Wet preparation
- Soft extrusion
- Stick drying
- Dry set
- Dehacker
PLASTIC CHEW CLAY STOCKPILE
SANDY ABEL STOCKPILE
SOFT EXTRUSION
MULTI-WIRE HARP CUTTER
DRYER RACK CAR LOADING
INDIVIDUAL “STICK” DRYING
SEMI-CONTINUOUS DRYER
24 WIDE KING SIZE DRY SET CAR
DEHACKER
PLANT STARTUP ISSUES IN 1985......

- Extrusion laminations
- Excessive dryer cracking
- Pre-heat cracking
- Cooling cracking
- Poor fired strength
- High bat loss (>50%)
- Poor quality
- Disastrous cost impact
AFTER MUCH RESEARCH, MANY TRIALS AND ERRORS......
IN 1987 A GROG PLANT WAS INSTALLED AND BOTTOM ASH WAS INTRODUCED
FAST FORWARD 25 YEARS
PURPOSE OF THE WORK

• To study the characteristics of the combined materials, with and without bottom ash.
• To determine the mechanisms at work which make the bottom ash effective.
• To understand the key process control parameters necessary for ongoing success.
• To provide scientific evidence of the benefits of bottom ash in the manufacture of clay face brick.
SFP test bodies

Non – bottom ash body (SFP-17)

- Chew clay: 50%
- Abel sand: 50%

Current SFP bottom ash body (SFP-18)

- Chew clay: 53%
- Abel sand: 32%
- Bottom ash: 15%
Analyses performed

- Dry and fired physical properties
- Particle Size Equivalent
- Pore size distribution
- Simultaneous Thermal Analysis
- Chemical analysis
- Mineralogy XRD
- Microscopy
FINDINGS
Linear Shrinkage and Strength Comparison

Sample

SFP-11-16 Chew Composite
SFP-11-17 No B.A.
SFP-11-18 15% B.A.

% Shrinkage

Fired Modulus of Rupture, lb

Wet to Dry
Dry to Fired
Fire MOR
Particle Size Equivalency Comparison

- SFP-11-16 Chew Composite
- SFP-11-17 No B.A.
- SFP-11-18 15% B.A.

Legend:
- Sand
- Silt
- Clay
PORE SIZE DISTRIBUTION

Dry Brick

Incremental Intrusion Volume (ml/g)

Pore Diameter (µm)

SFP-11-17 Dry
SFP-11-18 Dry
DTA ANALYSIS

H2O Peak: 512.6 °C

Absorbed Water

Dehydroxylation

Temperature /°C

H2O

H2O Peak: 512.6 °C

[1] Acme_SFP-11-17 b.dsu
H2O
H2O
Approximate chemistry and mineralogy of the SFP body components.

<table>
<thead>
<tr>
<th>Chemistry</th>
<th>Chew clay %</th>
<th>Abel sand %</th>
<th>Bottom ash %</th>
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<td>SiO2</td>
<td>46.1</td>
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<td>Al2O3</td>
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<tr>
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<td>MgO</td>
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<tr>
<td>TiO2</td>
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<td>0.32</td>
<td>1.29</td>
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<td>S</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
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<table>
<thead>
<tr>
<th>Mineralogy</th>
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<tr>
<td>Quartz</td>
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<tr>
<td>K-feldspar</td>
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<tr>
<td>Plagioclase-fsp</td>
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<tr>
<td>Mica/illite</td>
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<td>Smectite</td>
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<tr>
<td>Kaolinite</td>
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<tr>
<td>Calcite</td>
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<tr>
<td>Clinopyroxene</td>
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<td>Gehlenite</td>
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## Comparison of chemical and mineralogical compositions: SFP17 and SFP18

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<th>Approx unit</th>
<th>SFP 17 no BA unfired</th>
<th>SFP 17 no BA fired</th>
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<td>SiO₂</td>
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**Mineralogy**

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<tr>
<td>Plagioclase</td>
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<td>&lt;5</td>
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<tr>
<td>Smectite</td>
<td>%</td>
<td>21</td>
<td></td>
<td>22</td>
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<tr>
<td>Calcite</td>
<td>%</td>
<td>11</td>
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</tr>
<tr>
<td>Kaolinite</td>
<td>%</td>
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<td>%</td>
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MIRCOSCOPIIC ANALYSIS
NON BOTTOM ASH BODY
SAN FELIPE PLANT TODAY

• > 100 MMBE per year
• Exciting range of Heritage KS Face Brick
• Excellent quality
• Effective QC controls
• < 2% Bat loss
• Highly profitable
• LEED credits
• EPA threat
ECONOMICS OF BOTTOM ASH

- Soluble salt content requires BaCO$_3$ usage
- Finer grinding needed to reduce “pyrite popping”
- Low cost body component
- Some energy benefit from autogenous combustion of carbon
- Energy reduction potential
- Process losses reduced
- LEED point advantage
CONCLUSIONS: Using Bottom Ash

- Reduces laminations
- Reduces drying shrinkage
- Reduces drying sensitivity
- Reduces dehydroxilation moisture
- Plagioclase feldspar phase increased
- Acts as an effective, stable flux
- Increases fired strength
- Reduces quartz inversion stresses
- Reduces process losses
- Non-hazardous body component
FINISHED PRODUCT QC