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CII

SUSTAINABLE DEVELOPMENT GOALS

14th Edition
Conference on Alternative Fuels & Raw Material
23rd -24th Oct'2024

"Minimize Refractory Challenges in sustainable way when using Alternative Fuel in Cement Production Process"

Subrat Chhotray, HASLE Refractories
Aravind Prabu, HASLE Refractories

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Content

- HASLE Brief Introduction
- HASLE Product Range and Raw Material Characteristics
- Alternative Fuels & Sustainability
- HASLE Unique Refractory Solution- Modular Lining
- Case Stories
- Conclusion & a way forward to Sustainability
- Q & A

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HASLE Refractories in brief:

- Privately owned company est. 1843
- Head office, R&D and production in Denmark
- Subsidiaries in India and Thailand with our European Sales office in Copenhagen
- Annual Capacity +20.000 tons LCC + 1000 tons of Precast
- Worldwide sales to over 50 countries




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OUR SERVICES

ENGINEERING

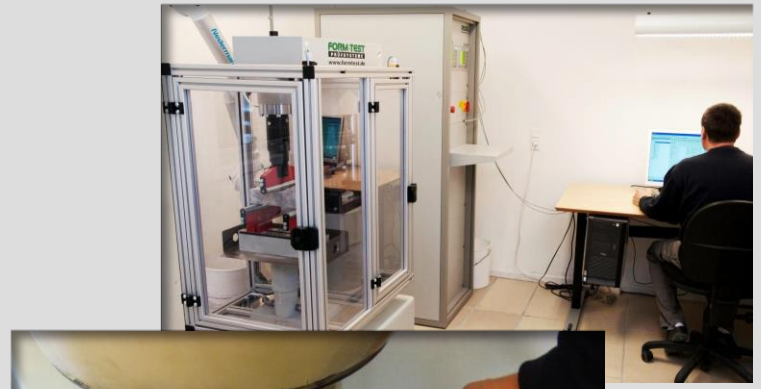
- From our HQ, we provide engineering, consulting and designing for refractory lining

TESTING

- In our own laboratory, we carry out various tests to measure and secure our materials performance as per specific customer process environments.

SUPERVISION

- We provide technical supervision for installation of all our products
- Supervision is carried out by highly skilled HASLE supervisors



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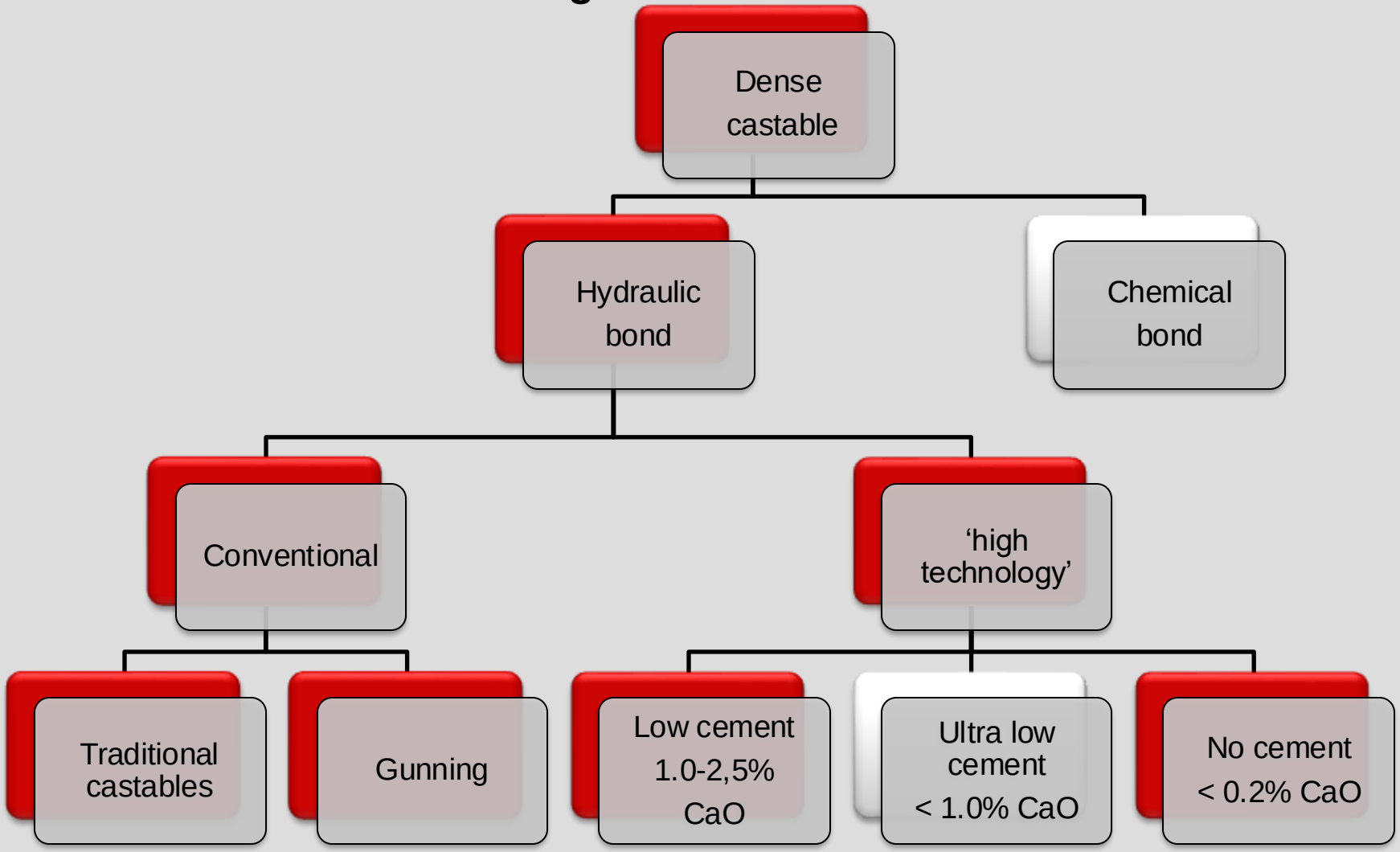
HASLE Product Range and Raw Materials Characterization

HASLE Product Range and Raw Materials Characterization



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RAW MATERIALS CHARACTERIZATION

- Chamotte (calcined fireclay): 40-45 % Al_2O_3 = Alkali resistance
- Andalusite (natural mineral): 55-60% Al_2O_3 = Shock resistance
- Mullite (calcined bauxitic clay): 70 % Al_2O_3 = Mechanical Strength
- Bauxite (calcined mineral): 85-90% Al_2O_3 = Abrasion resistance
- Corrundum (alumina): 99% Al_2O_3 = High refractoriness
- Silicon carbide: SiC = High thermal conductivity, shock resistance
- Microsilica (pure SiO_2 fuse) = Densification and workability
- Various SiO_2 and Al_2O_3 fines = Mullite formation

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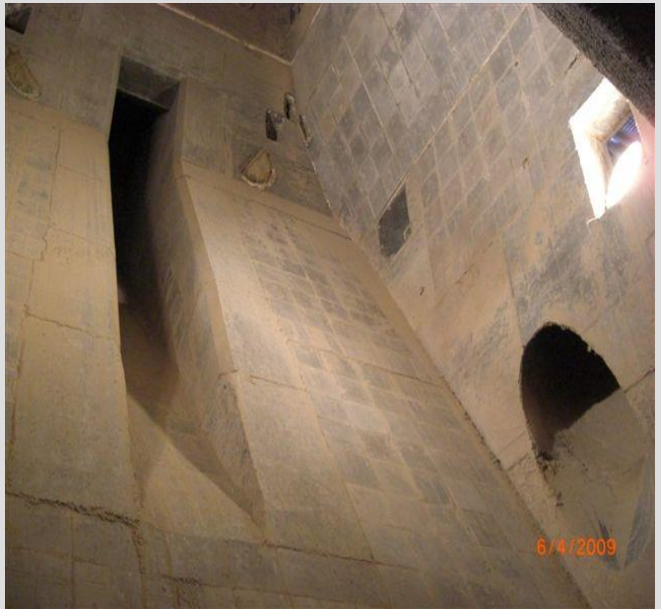
Characteristics of HASLE Products:
HASLE Refractory products are known around the world for it's outstanding properties and resistance to:

- High Temperatures (1000°C – 1800°C)
- Chemical Attack
- Thermal Shock
- Erosive & Abrasive Wear
- Build-Up / Slag
- Mechanical stress



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Alternative Fuels and Sustainability

Use of Alternative Fuels in Cement Plants

Conventional Fuel: Fossil Fuels like Coal, HSD, Natural Gas

Alternative Fuel:

- Pet Coke,
- Muncipal Soild Waste MSW/RDF
- Pharmaceutical Waste
- Bio-mass Wastes
- Rejected Tyres
- Waste Solid and Liquid Plastics
- Industrial Oils, wood chips etc...

Alternative Fuel & Sustainabilty:

- Scarcity of Conventional Fuel
- High Cost of Conventional Fuel
- Alternative Fuel like Tires, Plastics, RDF provide comparable LHV to that of Coal though not higher than it
- Lesser emission of CO2 and other green house gases
- Eco System- Preserve Natural resources
- Better Waste Management

Process & Refractory Challenges due to Use of Alternative Fuels

- Poor Heat Distribution
- Unstable Pre-calciner Operation
- Dusty Kilns
- **Incombustible material forms Ash**
- **High Amount of Hazardous Volatile Gases: Alkalies, Sulphates, Chlorides**

e.g.

MSW/RDF: Introduces more ash with high content of alkalis and chlorides

Pet Coke: Introduces high amount of Sulphates

Pharmaceutical Wastes: High Amount of Chlorides

$(CaO, K_2O, Na_2O) + (SO_3, Cl) \rightarrow (Na_2SO_4, K_2SO_4) + (NaCl, KCl)$

Reactions of volatile Alkali, Sulphate and Chloride:

Alkalis: Na_2O and K_2O

React with **Al_2O_3** in Refractory and form new crystal structures with higher volumen

Also form sticky build-up on the Refractory surface

Sulphates: SO_3

React with Na_2O and K_2O, MgO, CaO, and causes brittleness of refractory

Chlorides: Cl

Infiltrate easily in refractory lining and condensate & React with Na_2O and K_2O and increase the presence of vapor phases

Standard cup-test of Normal LCC Vs D39A Vs D59A

Cup test on a "normal" castable that fractured in 4 pieces due to alkali spalling.

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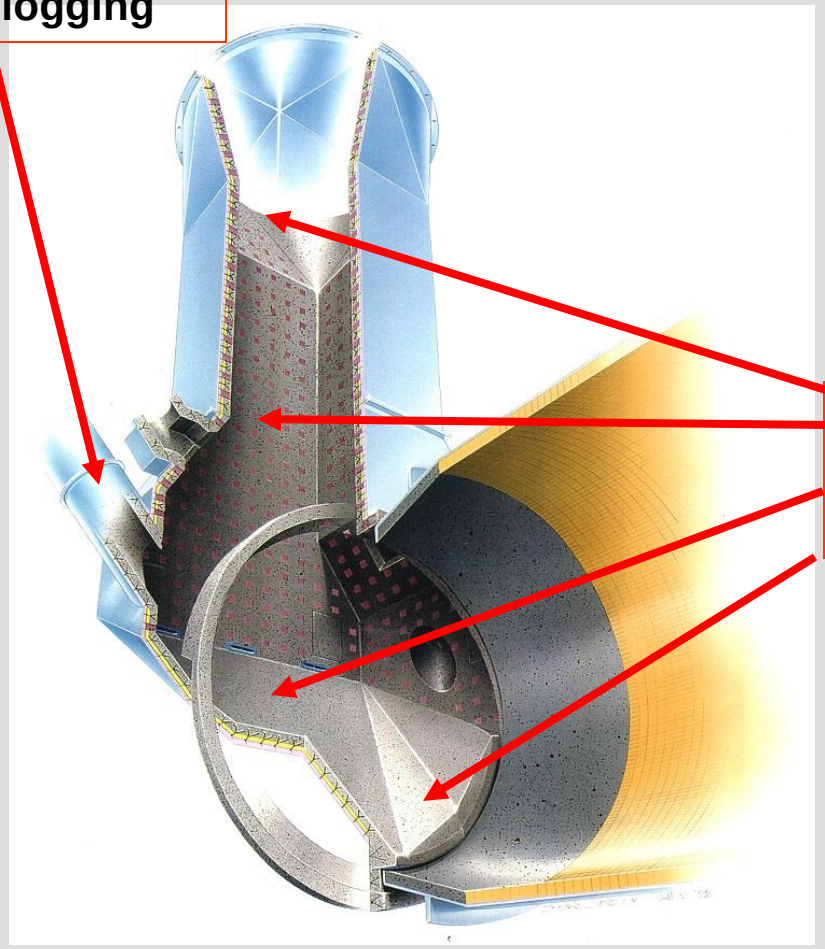
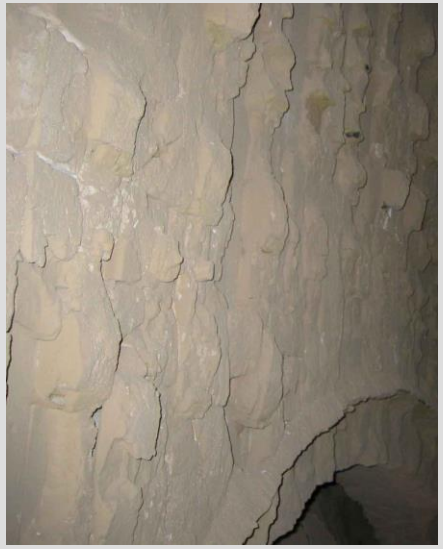
Effect on Cement Process and Refractories

Sulphate, Chloride & Alkalis attack and Build Up formation

Build-up formation, clogging



Most Effected areas by Alkalies & Sulphate



Coating in Smoke Chamber

Coating in Riser Duct

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HASLE Unique Refractory Solution- Design & Detail

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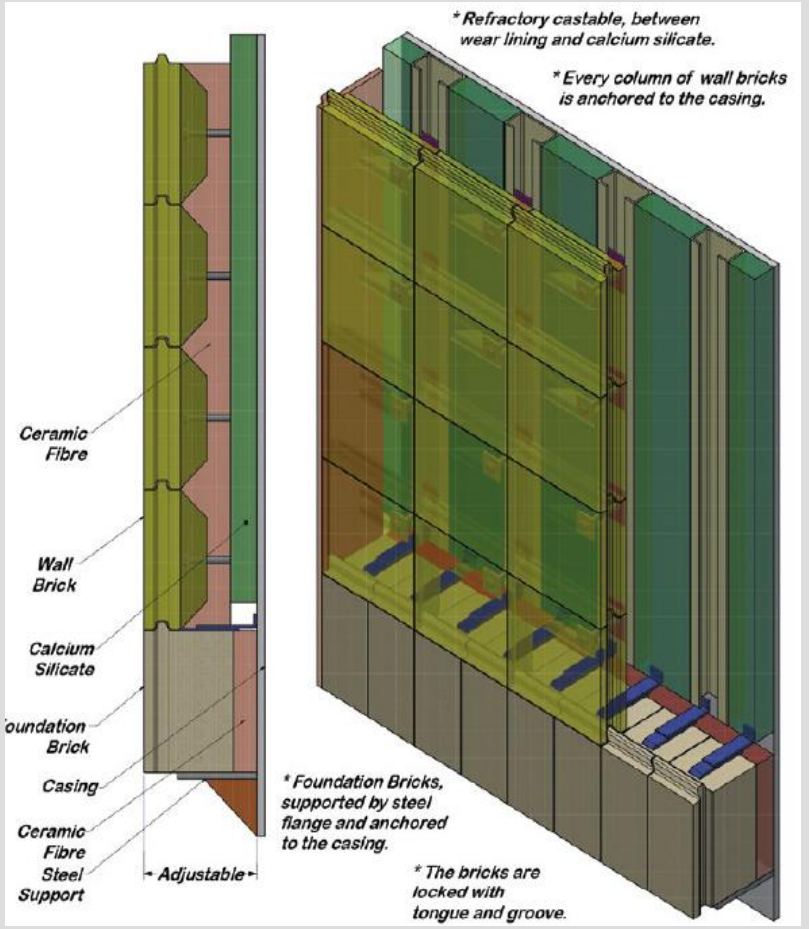
How HASLE Modular Lining Solution can help in improving the life of Refractory Lining

1. The Precast elements are casted and Pre-fired under controlled condition for Maximum strength & low porosity (9-10%) and surface permeability
   - which Does not allow coating to stick with precast
2. High Quality raw material ensures no /less reactivity with Hazardous Chemicals Like Alkalis, Sulphates & Chlorides
3. Longer life 3-4 times compared with casted lining
4. Thinner lining is possible- with same or less heat loss
5. Precast size 250x250mm, (15-16kg) easy to install



HASLE Unique Refractory Solution- Design & Detail

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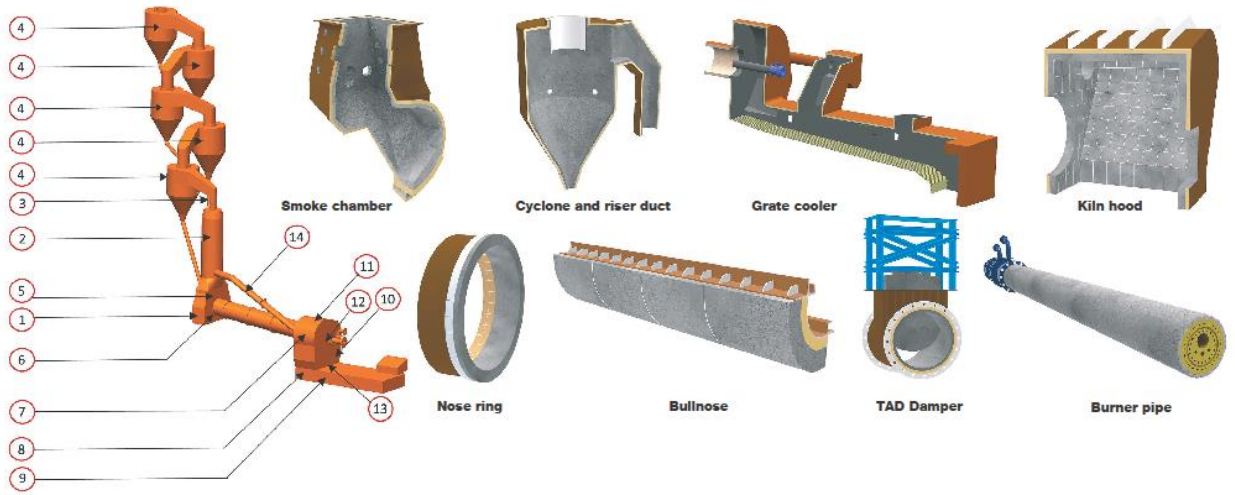
HASLE Castable for hot face lining in cement kiln with grate cooler



	Thermal shock resistance	Alkali resistance	Slag/build-up resistance	Abrasion resistance	Strength	Thermal conductivity	1 Smoke chamber	2 Calcinator	3 Riser duct	4 Cyclones and cyclone roots	5 Inlet arch	6 Inlet cone	7 Nose ring	8 Horse shoe	9 Side walls and roof	10 Inlet wall	11 Kiln hood	12 Burner pipe	13 Bull nose	14 Tertiary air duct
D39A	●	●●●●	●●●	●●●	●●●	●	✔	✔	✔	✔					✔					✔
D52A	●●	●●●	●●●	●●●	●●	●	✔	✔	✔	✔				✔	✔	✔		✔	✔	✔
D65A	●●●	●●●	●●●●	●●●	●●●●	●●												✔	✔	✔
D59A	●●●	●●●	●●●	●●●	●●	●●			✔	✔				✔	✔	✔			✔	✔
D66	●	●●	●●●	●●●●	●●●●	●														✔
D1550SC	●●●	●●●	●●●	●●●●	●●●	●●●	✔	✔	✔	✔	✔	✔	✔	✔		✔		✔	✔	✔
D1600SC	●●●●	●●●	●●●●	●●●●	●●●	●●●●	✔	✔	✔	✔	✔	✔	✔	✔		✔		✔	✔	✔
GUN39A	●	●●●●	●●	●	●	●	✔	✔	✔	✔		✔					✔			✔
GUN59A	●●	●●●	●●●	●●	●	●	✔	✔	✔	✔		✔			✔	✔	✔		✔	✔
MODULAR LINING	●●●	●●●	●●●●	●●●●	●●●●	●●	✔		✔	✔	✔				✔	✔	✔		✔	✔

●= Low
●●= Medium
●●●= High
●●●●= Extra high

✔= Recommended for this area – General recommendations

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Case Stories from Cement Plant

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HASLE Modular Lining /Precast- Case Stories

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HASLE Modular Lining- in different Areas of Cement Plant- Inlet Riser

Country- Thailand

Line Capacity- 8000 TPD

AFR- 10% RDF

Area- Inlet Riser area

Problem- Heavy Coating on casted lining

HASLE ML/ Precast- 4.5 Years without Coating

after 4 years

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HASLE Modular Lining- in different Areas of Cement Plant- Kiln Inlet Slope

Country- India

Line Capacity- 10000 TPD

AFR- 15% Mix AF

Area- Inlet Slope Area

Problem- Heavy Coating on casted lining

HASLE ML/ Precast- 5 Years without Coating

Installation Picture

after 3 years without any coating

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HASLE Modular Lining- in different Areas of Cement Plant- Feed/Meal Pipes

Country- India

Line Capacity- 10000 TPD

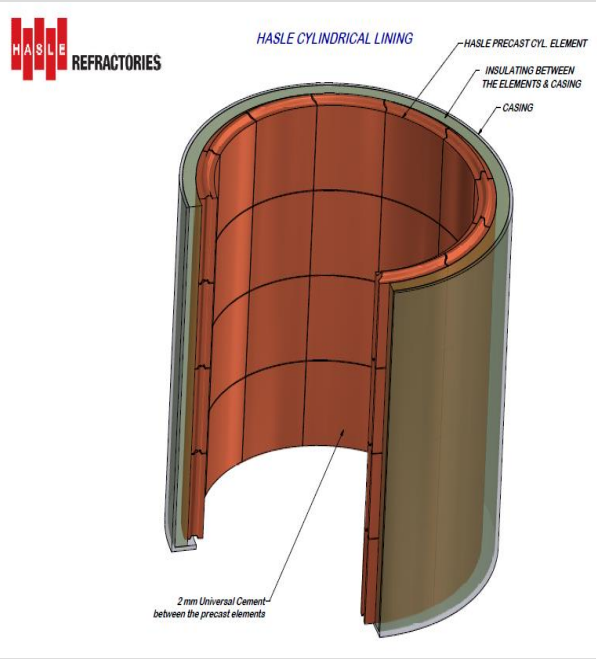
AFR- 100% Pet Coke in Main Burner

Area- Feed Pipes

Problem- Heavy Coating on casted lining

HASLE ML/ Precast- 6-8 Years without Coating

Coating in feed pipe before Pre-cast installation



Standard Design of Precast Lining in Feed pipe

Pre-cast Feed Pipe-after 5 Years without any coating

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HASLE Modular Lining- in different Areas of Cement Plant- Cooler Bull Nose

Country- Vietnam

Line Capacity- 5000 TPD

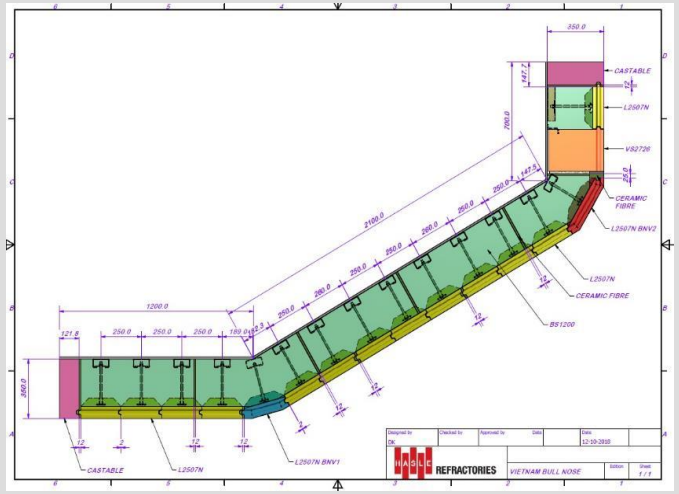
AFR used - 30% RDF

Area- Cooler Bull Nose

Problem- Only 12 months life

with castable due to high erosion

HASLE ML/ Precast- 4 Years



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HASLE Modular Lining- in different Areas of Cement Plant- Cooler Roof

Country- Germany

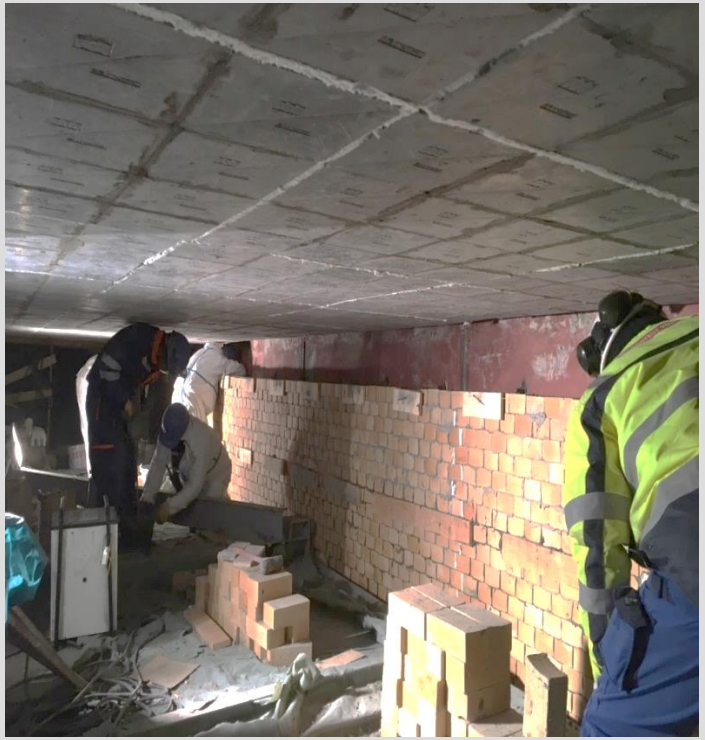
Line Capacity- 5000 TPD

AFR used – 82-95% RDF

Area- Cooler Roof

Problem- Only 24 months life with Bricks due to high erosion

HASLE ML/ Precast- 5 Years still running



Installation Pic-2018

After 5 Years

HASLE Modular Lining- in different Areas of Cement Plant- Inlet Arch

Country- India

Line Capacity- 5000 TPD

AFR used – 10 to 12%

Area- Inlet Arch

Problem- Less than 12 months life with casted lining

HASLE ML/ Precast- 4 Years

After 24 months

After 36 months

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Conclusion & Way forward to Sustainability

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Conclusion and Way forward to Sustainability

- HASLE Products are resistant to Hazardous Chemicals like Alkali, Sulphur & Chlorides
  - ✓ Support more & more charging of Alternative fuel
  - ✓ Avoid frequent/annual repairing of refractory
  - ✓ Avoid Pre-mature failure of refractory in critical areas which involves loss of lot of Natural resources, Fuel & Money and reduces overall plant sustainability goal

- HASLE Precast is resistant to Coating and provides jamming free operation
  - ✓ Optimize the process by providing designed operational area all the time
  - ✓ Avoid frequent cleaning of coating
  - ✓ Use of lesser number of Air Cannons which reduces electric consumption

Conclusion and Way forward to Sustainability

- HASLE Precast provides extended life (3-4 times) compared to Castable Lining
  - ✓ Less consumption of refractory over the period of time- lesser consumption of natural resources and energy
- Thinner lining is possible up-to 185 mm with lesser/same heat loss
  - ✓ Less consumption of natural resources per square meter area

- All this can be done without use of Silicon Carbide based Refractory which has high thermal conductivity- HASLE Products improves thermal efficiency of plant
- Un-limited Shelf Life- avoid wastage of material due to shelf-life constraint

End of PPT

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