ADVANCEMENTS IN REFRACTORY MAINTENANCE PRACTICES IN RINL – VISAKHAPATNAM STEEL PLANT

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VISAKHAPATNAM STEEL PLANT

- Is a subsidiary of **Rashtriya Ispat Nigam Limited**
- Is a public sector enterprise under the Ministry of Steel, Govt. of India
- Is the first shore based Integrated Steel Plant in the country
- Has three Blast Furnaces, six LD Converters and six rolling mills
- Has a rated production capacity of 7.3 MT Hot Metal and 6.8 MT liquid steel

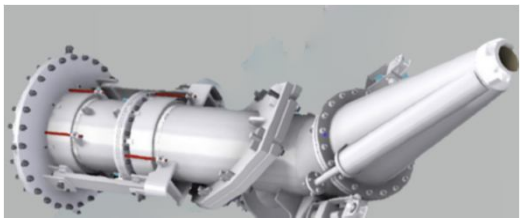
REFRACTORY ENGINEERING DEPARTMENT

- Procures, installs, inspects and maintains the refractories in various furnaces
- Caters to Sinter Plant, Blast Furnace, Steel Melt Shop, Rolling Mills, Calcining Plant, Thermal Power Plant and Foundry
- Continuously strives to reduce the specific refractory consumption

Major technological Modifications

- Increasing life of Tuyere Stock Assembly in Blast Furnace
- Reducing End wall repairs in Sinter Machine-1
- Using in-house produced burner blocks in Sinter Machine-1
- Thermal scanning of Converter in Steel Melt Shop
- Thermal Scanning of Steel Ladle in Steel Melt Shop

Tuyere Stock aSSembly



Tuyere Stock Assembly

- Downleg

- Elbow

- Blowpipe

Tuyere Stock aSSembly

- It was observed that tuyere stock assembly couldn't sustain temperatures beyond 1050^{o}C
- These tuyere stock components were casted with 70% self flow alumina castable which was inadequate to handle high temperatures beyond 1050^{o}C
- Hardened paper moulds were used for casting which could not properly maintain uniform hot blast passage during casting.
- So refractory composition, design & application procedure was changed

Tuyere Stock aSSembly

STAGE 1 modification :

- Chrome based alumina self flow castable was used for casting
- Rubber moulds were used instead of paper moulds

BLOWPIPE MOULD

DOWNLEG MOULD

Tuyere Stock aSSembly

Results :

- Composition change did not enhance the life as expected

- Rubber moulds showed better results in downleg and blowpipes casting
- But many elbows were off centered, due to rubber moulds

Tuyere Stock aSSembly

STAGE 2 modification :

- 60% alumina based self flow castable was used for casting
- Thermocol moulds were used for elbow casting

Tuyere Stock aSSembly

Results :

- Composition change enhanced the performance of tuyere stock assembly
- Thermocol moulds resolved the off centering issue in elbow casting
- However, the narrow end tip of blowpipe sometimes developed red spot

- Heavy vibrations were observed in PCI lance during operation

Tuyere Stock aSSembly

STAGE 3 modification :

- Casting thickness of blowpipes was increased by 10mm

- Diameter of PCI holding vent in blowpipes was reduced

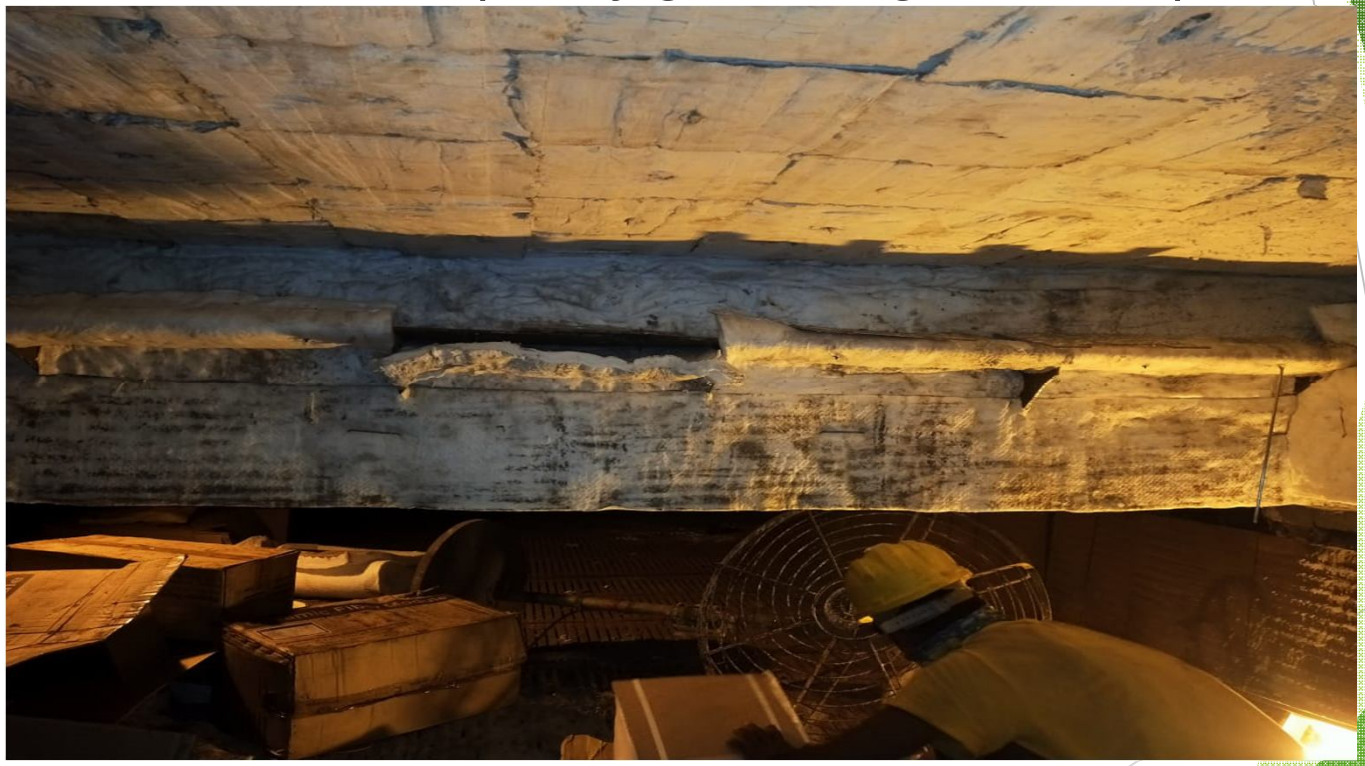
Tuyere Stock aSSembly

Results :

- Increasing the casting thickness eliminated the occurance of red spots
- PCI pipe displayed less vibrations thereby improving life of blowpipes
- No abnormalities have occurred in the tuyere stock assembly since then

Sinter Machine end wall

- As per OEM design, it was lined with ceramic modules
- However the end wall frequently got damaged and required repair often



- Castable patching was done on the inner side of end wall to increase longevity but to no avail

Sinter Machine end wall

- It was proposed to install bull nose at the end wall
- The beam to support bull nose was prepared and tested

Sinter Machine end wall

- The beam was installed at the end wall and bull nose lining was done

- The performance of the bull nose is on a par with expectations

Sinter Machine Burner BlockS

- The burner blocks provided by Sinter Machine-1 OEM often developed cracks even before installation
- To avoid any shortage of blocks, it was planned to prepare burner blocks with in-house resources
- Iron frame for casting was prepared

Sinter Machine Burner BlockS

- These blocks did not develop any cracks over long period of time
- The burner blocks were installed in Sinter machine -1 roof

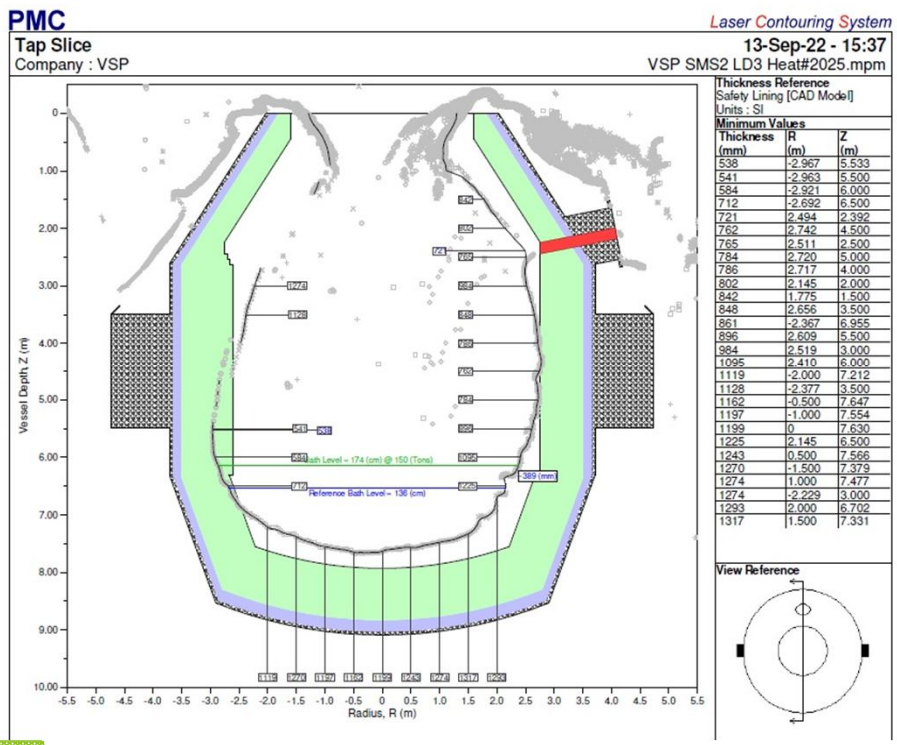
- After prolonged use it was observed that the indigenously prepared burner blocks had a better performance than the OEMs

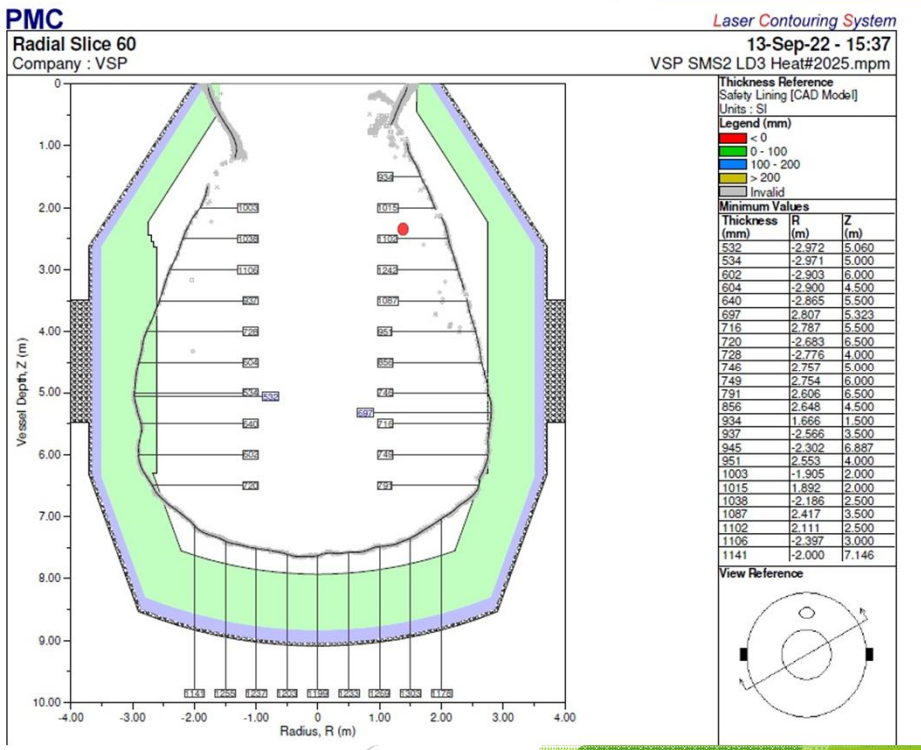
THERMAL scAnning OF cOnVERTERs

- Manual inspection of LD Converters sometimes lead to incorrect assessment of converter health
- For effective inspection of converters, thermal scanning was introduced

THERMAL scAnning OF cOnVERTERs

- Detailed refractory leftover thickness is measured and displayed





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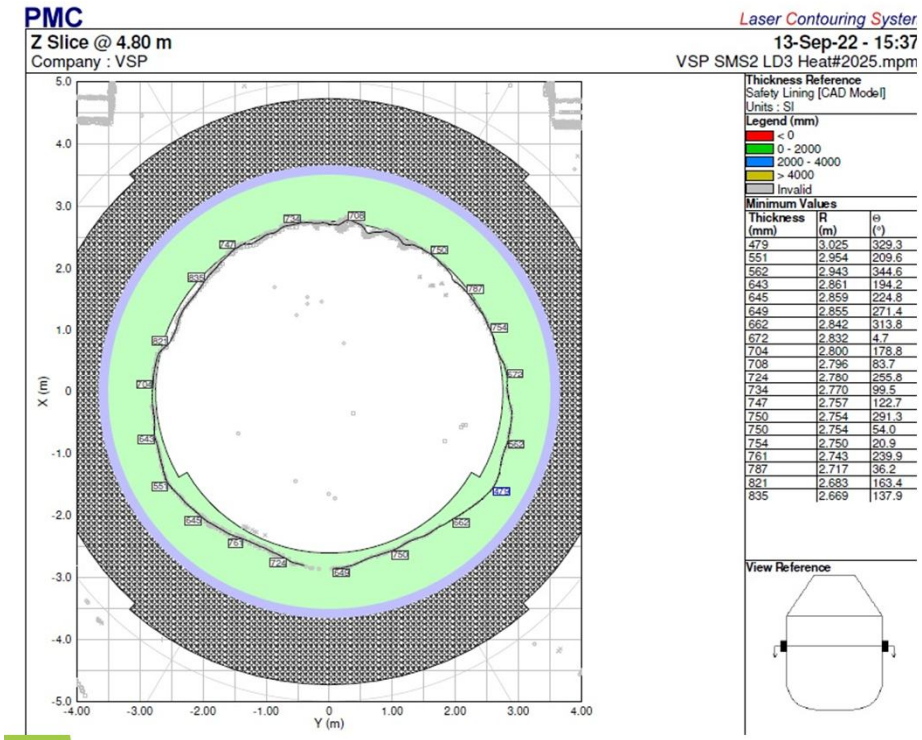
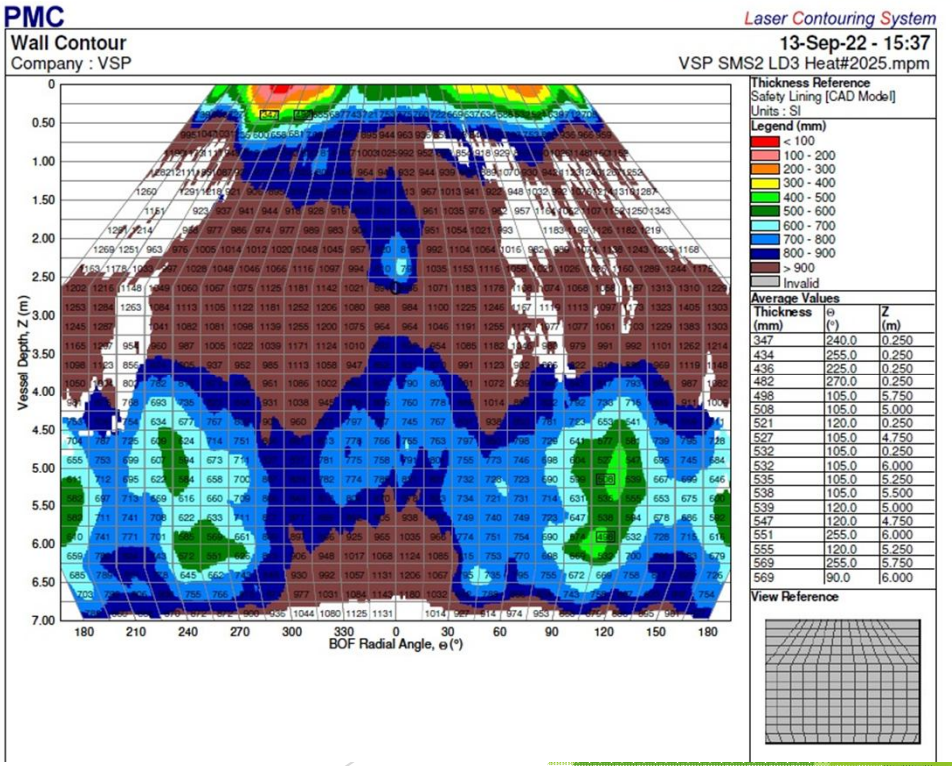


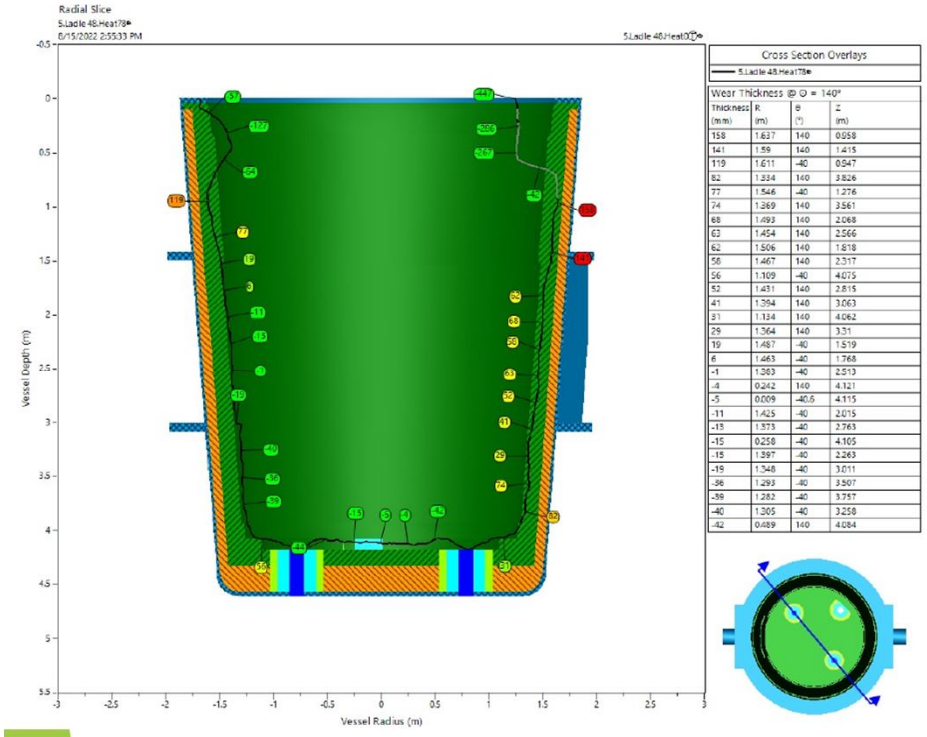


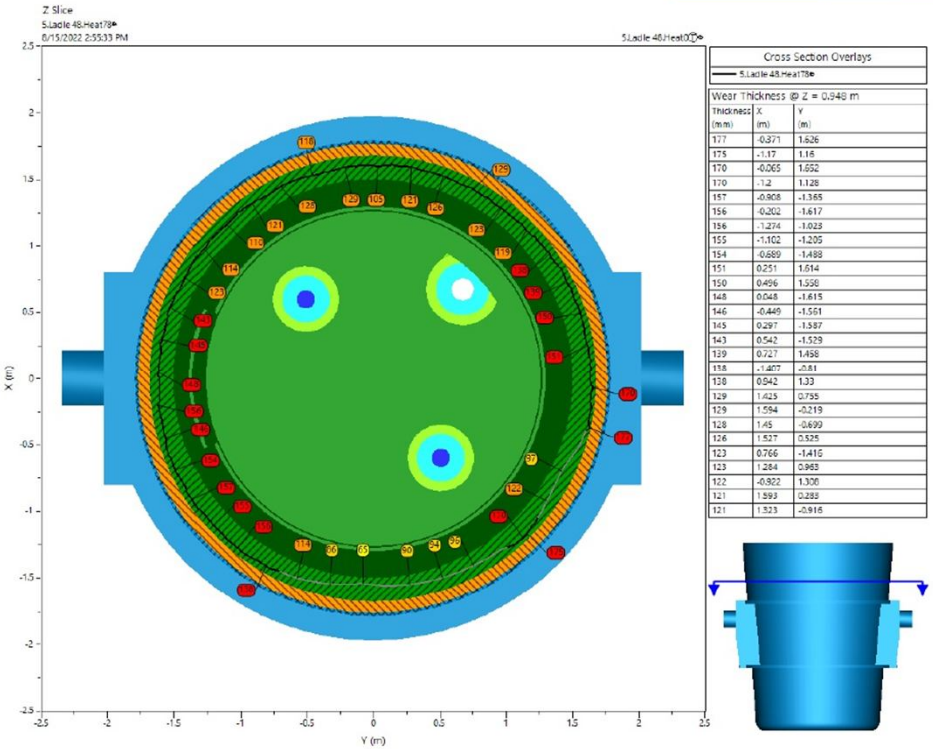
THERMAL scAnning OF sTEEL LADLE

- Life prediction of steel ladles based on manual inspection were often incorrect
- To get an accurate idea of refractory condition in ladles, thermal scanning was introduced in steel ladles

THERMAL scAnning OF sTEEL LAdLE

- Detailed refractory leftover thickness is measured and displayed





THERMAL scAnning OF sTEEL LAdLE

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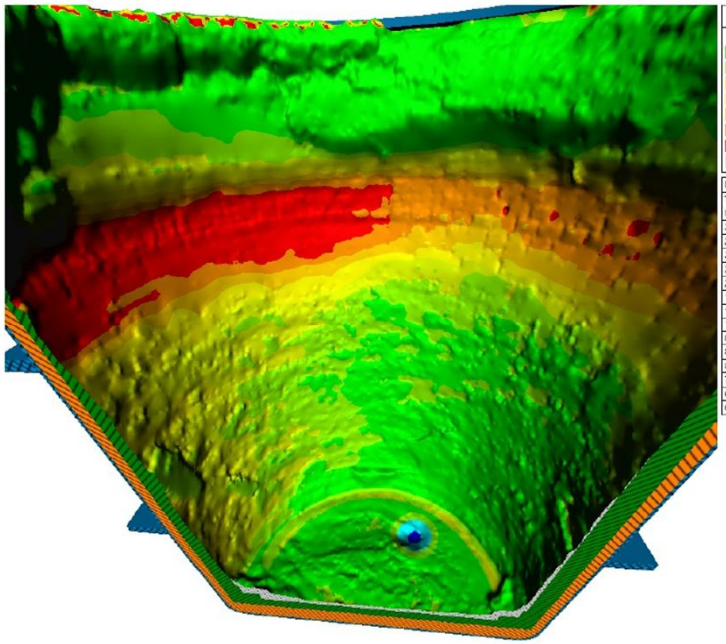
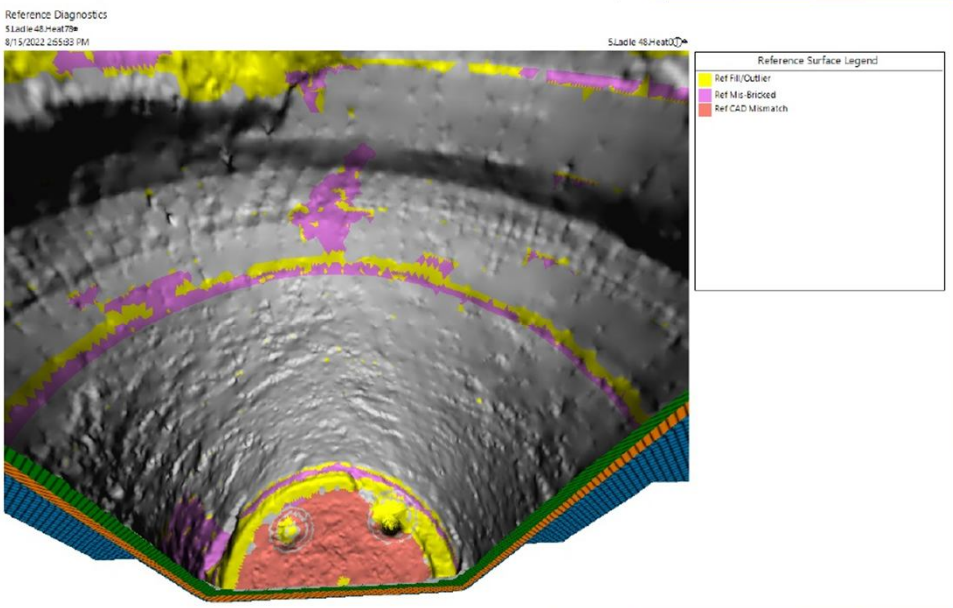


Wear (mm)

Wall	Bottom
< 0 mm	< 0 mm
0 mm : 26 mm	0 mm : 50 mm
26 mm : 52 mm	50 mm : 100 mm
52 mm : 78 mm	100 mm : 150 mm
78 mm : 104 mm	150 mm : 200 mm
104 mm : 130 mm	200 mm : 250 mm
> 130 mm	> 250 mm
Invalid	

Maximum Wear

Thickness (mm)	X (m)	Y (m)	Z (m)
288	0.896	-1.528	0
257	-1.117	-0.845	0
255	0.671	-1.308	0.012
249	1.706	0.674	0
247	0.714	-1.66	0
195	1.677	-0.555	0.048
165	-1.462	-0.79	0
108	1.898	-0.598	2.899
88	-1.33	-0.809	1.512
86	-0.335	-1.513	1.549
85	0	-1.54	1.487
75	0.95	-0.607	4.078
65	0.989	-0.571	4.075
61	1.42	0.554	1.515



Thermal scanning of converTer & steel ladles

Results :

- Accurate refractory thickness data helped in better analyzing the health of refractory lining in converter and steel ladle
- Effectiveness of various maintenance practices could be easily verified
- Better life predictions were possible in steel ladle
- More effective refractory maintenance pratice were developed in converters

Initiatives in pipeline

- Zonal lining of rotary kilns to reduce repairs and enhance refractory life
- Tuyere stock refractory to be modified to sustain 1200^{o}C
- Thermal scanners for SMS-2 steel ladle
- Thermal scanners for BF torpedo ladles
- In-house production of all sinter machine burner blocks

THANK YOU

ANY QUESTIONS?