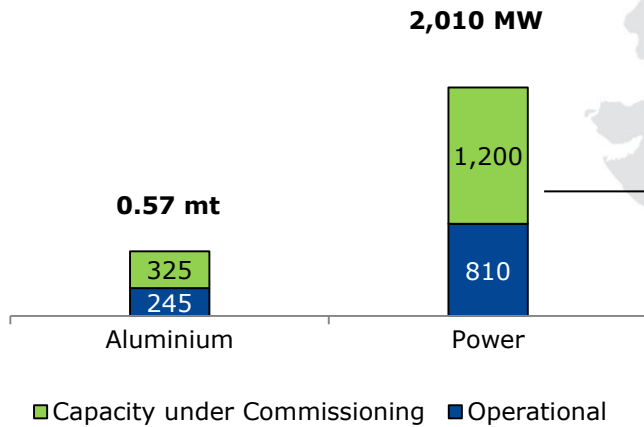


Technical Presentation on Spent Pot lining Management & Red Mud

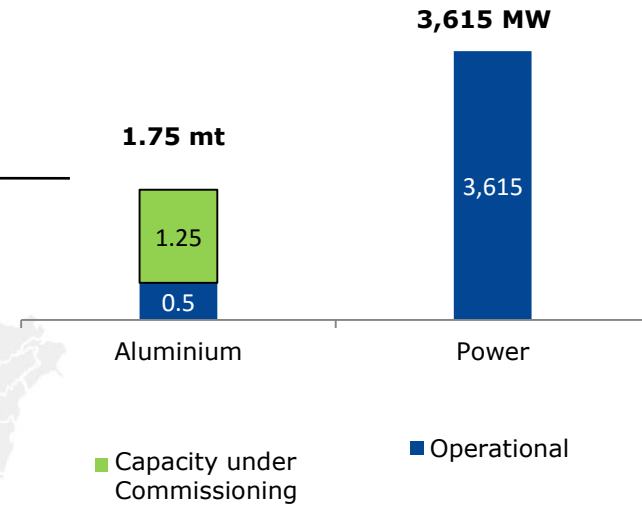


**Bharat Aluminium Company Ltd, Korba
&
Vedanta limited, Jharsuguda & Lanjigarh**

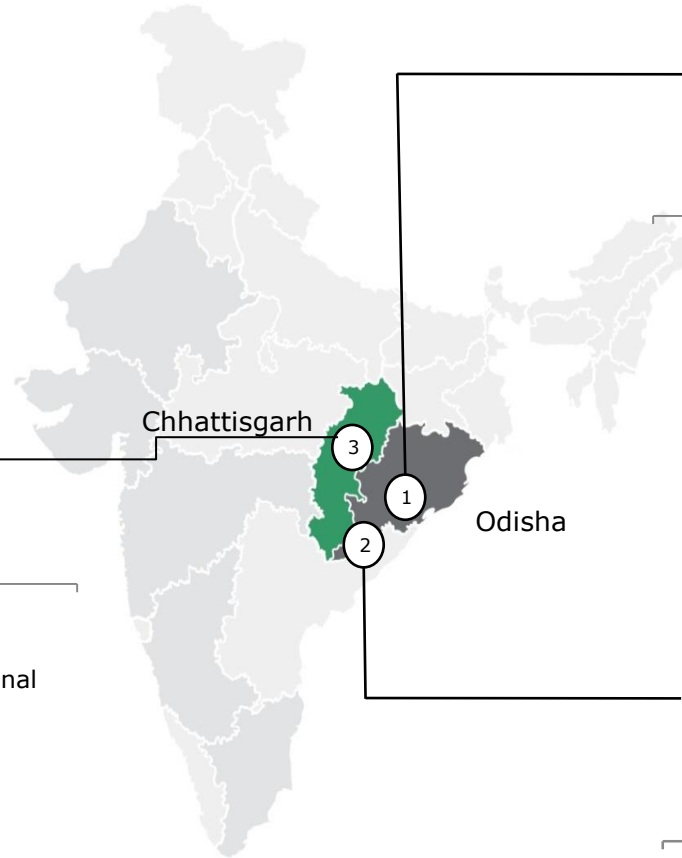
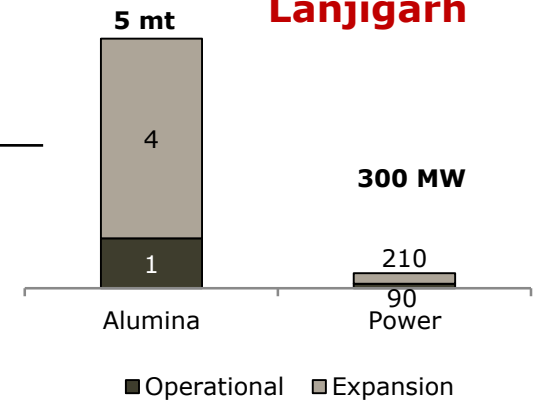
BALCO Smelter Capacity, Korba



Jharsuguda Smelter Capacity



Alumina Refinery Capacity, Lanjigarh



- ❖ Spent pot lining (SPL) is a by-product generated when the carbon and refractory lining of an aluminium electrolytic cell, known as a pot, reaches the end of its useful life.
- ❖ SPL is classified as hazardous material due to presence of fluoride and traces of cyanide.
- ❖ SPL has refractory part and carbon part. Carbon part which is used in Cathode consists of high calorific Graphite & Anthracite coal.
- ❖ **Refractory materials consists :**
 - DIM (Al_2O_3 castable refractory)
 - Calcium Silicate bricks
 - Insulating bricks (both refractory bricks and clay bricks)
 - Silicon Carbide blocks
- ❖ Cathode Carbon part gets impregnated with Fluorides, Alumina, Sodium, SiO_2 , Fe_2O_3 during the process of electrolysis. However the carbon part has high calorific value.

- ▶ As per GAMI technology SPL is generated @ 20 kg/T of metal.
- ▶ Average SPL generated from our smelters are as follows :

2.45 LTPA Smelter (BALCO) :

SPL generated from 2.70 LTPA Smelter is approx. 4000 - 5000 TPA .

5 LTPA Smelter (VAL) :

SPL generated from 5.0 LTPA Smelter is approx. 10,000 TPA .

SPL Generation from Future Expansion :

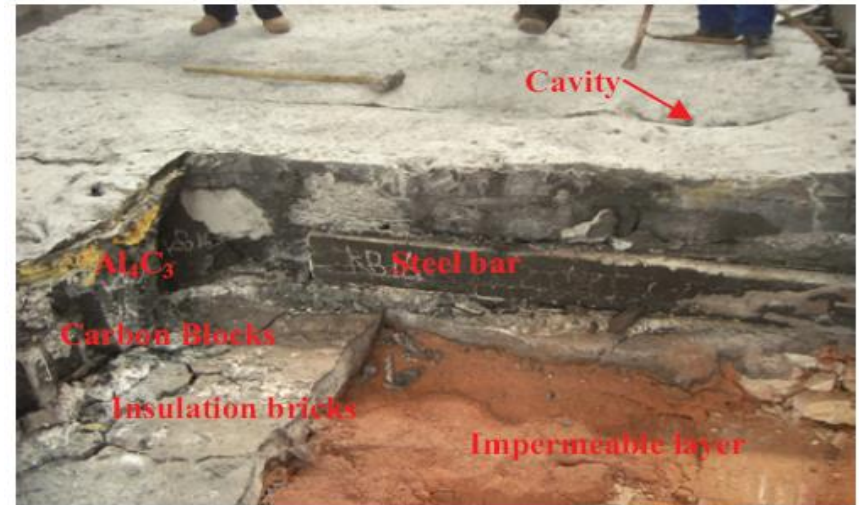
12.50 LTPA Smelter (Jharsuguda) :

SPL generation from 12.50 LTPA Smelter would commence after operation and annual generation will be to the tune of 25,000 TPA.

3.25 LTPA Smelter (BALCO) :

SPL generation from 3.25 LTPA Smelter would commence after 4 years of operation and would gradually increase to 7140 TPA. Presently this smelter is operational at 25% of installed capacity.






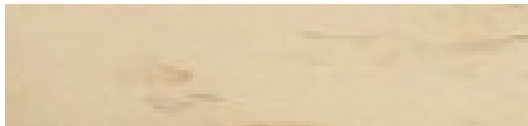
Spent Pot lining is being generated after shut down of every aluminium reduction cell.



Electrolytic cell after shut down

SPL contains two major parts -

1. Reacted Carbon Material
2. Reacted Refractory material

Material	Quantity	Appearance
Cathode Carbon Block And Carbon paste	40 MT	
Silicon Carbide	4MT	
Dry Impervious Material (DIM)	24MT	
Insulation Brick and Refractory Brick	5MT	
Refractory Castable	6.5 MT	
Calcium Silicate Insulation Board	0.5MT	

- For first cut material GCV varies from 3200 to 4500 Kcal/Kg (without wash).

Sl.No.	Parameters	Test Results	
		Units	Results Obtained Spent Pot Lining – Sample – 2 (2260/12)
1.	Silica as SiO ₂	% by mass	9.96
2.	Iron as Fe ₂ O ₃	% by mass	3.1
3.	Alumina as Al ₂ O ₃	% by mass	17.80
4.	Titanium as TiO ₂	% by mass	0.04
5.	Magnesium as MgO	% by mass	0.20
6.	Manganese as MnO	ppm	26
7.	Phosphorus as P ₂ O ₅	ppm	7
8.	Potassium as K ₂ O	% by mass	1.10
9.	Sodium as Na ₂ O	% by mass	14.9
10.	Antimony as Sb	ppm	< 1
11.	Fluoride as F (Total)	% by mass	12.9
12.	Arsenic as As	ppm	< 1
13.	Cadmium as Cd	ppm	< 1
14.	Chromium as Cr	ppm	1.0
15.	Copper as Cu	ppm	21
16.	Boron as B	ppm	< 1
17.	Lead as Pb	ppm	1.40
18.	Mercury as Hg.	ppm	0.40
19.	Nickel as Ni	ppm	12
20.	Zinc as Zn	ppm	< 1
21.	Cobalt as Co	ppm	17
22.	Cyanide as CN (Total) ,	ppm	< 0.1
23.	Cyanide as CN (Leachable)	ppm	< 0.1
24.	Carbon as C	% by mass	36.4
25.	Volatile matter	% by mass	1.88
26.	Ash content	% by mass	60.47
27.	Gross Calorific Value,	K.Cal/Kg	3380
28.	Moisture	% by mass	1.25

- HGI is 39 units.
- Total Fluorides 8-14%.
- Alumina – 16-20%.
- Sodium – 15%.
- SiO₂ – 10%.
- Fe₂O₃ – 3%.

A

- Temporary storage in water proof covered sheds

B

- Provision for Secured land fill as per CPCB design.

C

- Co-processing in Cement/Other industries.
- (Cement Industries like Rishi Cement, Ultratech & Subhra Chemical have tried our SPL for use in their plant)

❖ **ALBA:**

- ❖ Waste refractory bricks are crushed and used as a substitute for alumina to obtain a flat horizontal cathode shell surface prior to the start of laying insulation bricks for pot re-lining.
- ❖ At Alba, 60,000 cubic metres of spent pot lining (SPL) waste that had been generated over the past years were subjected to physical segregation into four fractions namely steel, carbon blocks, refractory and insulation bricks, and the fine fractions which cannot be segregated. All the steel was sold to a steel recycling furnace adjacent to Alba. The carbon and refractory portions are now being recycled in ways that have been approved by the environmental authorities, and which generate a financial return, to the extent that Alba alone has saved over US\$1million in the process.

❖ **ALCOA :**

- ❖ The multiple benefit of recycling SPL is both to eliminate landfill and extract the energy from it.
- ❖ Alcoa Fjardaál has a goal to recycle 100% of SPL generated in the smelter

❖ **EGA:**

- ❖ Spent pot lining (“SPL”) and carbon dust, both being forms of process waste generated in the reduction process, are recycled within the cement industry in UAE.

❖ **RUSAL :**

- ❖ Spent potlining (SPL) trial taken for utilisation. The behaviour of cyanide and fluoride under high temperature treatment has been investigated. On the basis of this laboratory investigation, the possibilities for SPL utilisation in red brick manufacturing, cement industry and thermal power stations are evaluated.

- As nation is poised for inclusive growth, industries should work together to reduce use of natural resources by promoting “**Reuse – Recycle – Reduce**” philosophy.
- SPL usage can be a promising proposal for both Cement and Aluminium industry to optimize their cost and be competitive.
- SPL usage can reduce COP of cement making, reduce use of natural resources.
- Cement and Aluminium industry should join hands and work out a ‘**win – win**’ solution. A part of the savings out of SPL usage by Cement industry may be shared with aluminium industry to make the proposal a viable solution.
- Storage of SPL is not a viable solution due to threat to land and water contamination.
- Advocacy from Government authorities is very much essential to promote recycling and reuse of SPL as alternate fuel (AFO).
- Japan is a pioneer in waste utilization in cement industry through mandate.

RED MUD UTILIZATION



First ever **RED MUD** powder plant in India

Vedanta Limited, Lanjigarh , ODISHA .

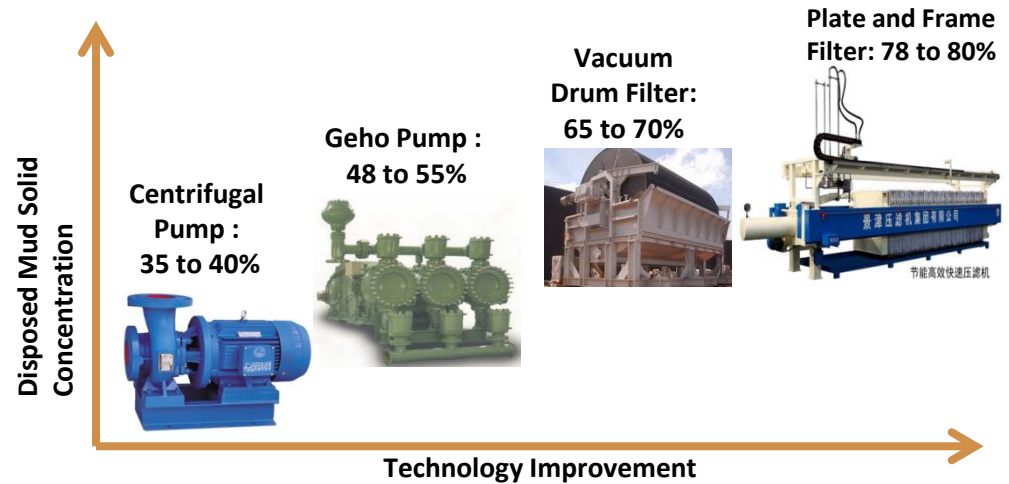
- Red Mud is produced during the Bayer process of Alumina production. It is the insoluble product after bauxite digestion with sodium hydroxide at elevated temperature and pressure.
- It is a mixture of compounds originally present in the parent mineral, bauxite, and of compounds formed or introduced during the Bayer cycle.
- The resulting liquor contains a solution of sodium aluminate and undissolved bauxite residues containing iron, silicon, titanium and undissolved Alumina.



- In Alumina refinery , lime is added for specific reasons at some point in the process and the lime forms a number of compounds that end up with the bauxite residue .
- Red Mud is a very fine material in terms of particle size distribution. Typical values would account for 90 % volume below 150 μm .
- Apart from the alkalinity that is imparted by liquors in the process; **RED MUD** is chemically stable and non-toxic.



- The red mud Filtration project which is first time in India, aims to convert the red mud pumping into the filtration system so that wet storage of bauxite residue can be avoided.



- The present global practice of red mud pumping by diaphragm pumps or filtration using vacuum filters which can give solid with around 40-45% moisture.
- The new filters (plate & frame) have been developed for red mud application & ensures the success to filter red mud and achieve moisture as low as 18-23 % and makes powdery red mud suitable for transfer by Conveyors.



HCSD SYSTEM



RED MUD FILTER



POWDER CONVEYING SYSTEM



STACKING OF RED MUD



LOADING RED MUD IN RAIL WAGONS



DESPATCH FOR CEMENT PLANT

Sl.No.	Parameter	Concentration (%)
1	Moisture	18 to 25
2	Loss On Ignition	8 to 11
3	Al_2O_3	18 to 23
4	Fe_2O_3	35 to 40
5	SiO_2	6 to 10
6	TiO_2	6 to 10
7	Na_2O	4 to 6
8	CaO	1 to 5

CEMENT MANUFACTURING

From our interaction with Cement Industries using Red Mud in their manufacture, it is understood that the composition of raw mix is decided by three moduli viz., Silica Modulus, Alumina Modulus and Lime Saturation Factor.

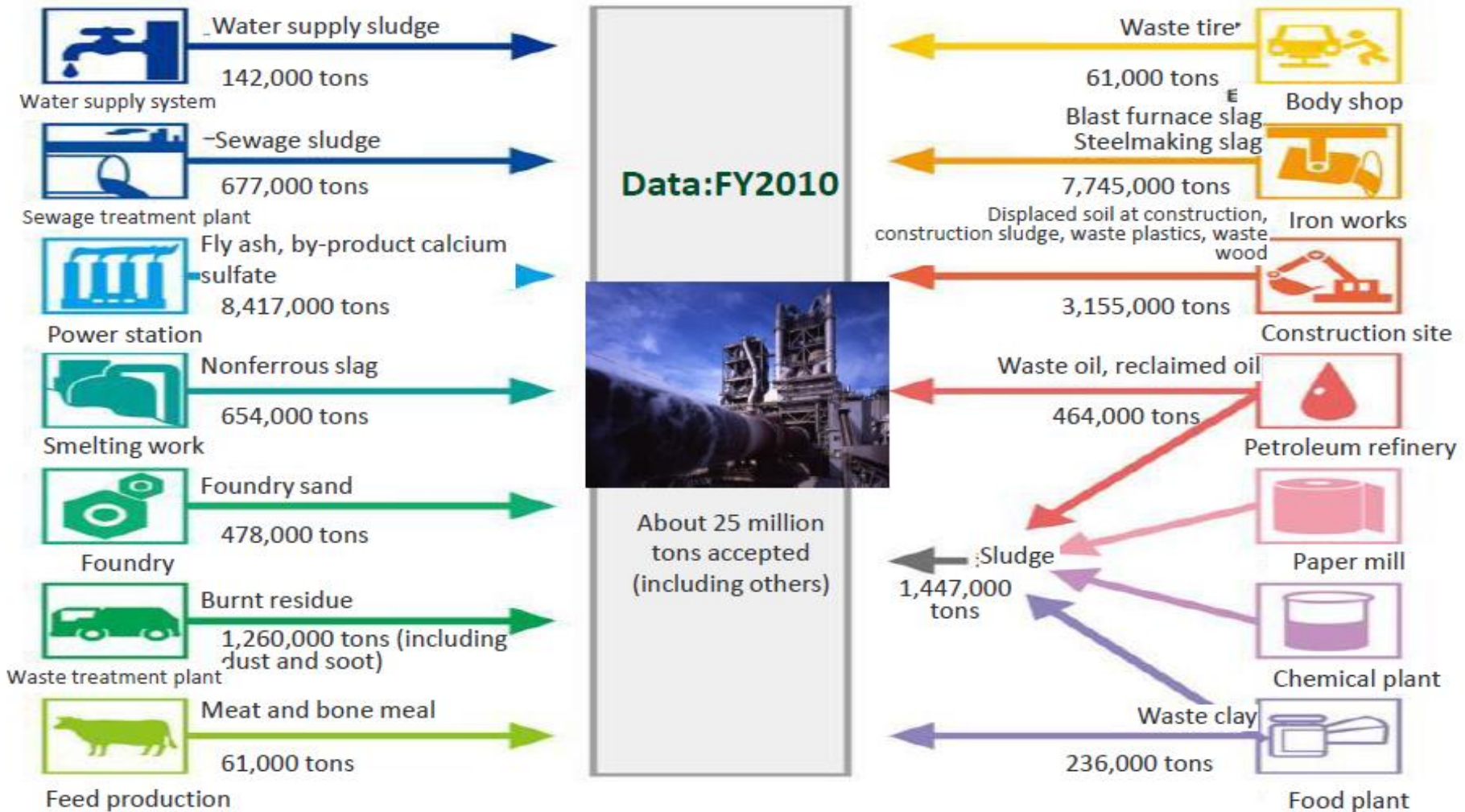
The required input for the Raw Mix is ensured by adding suitable quantities of lime stone, Gypsum, Bauxite, etc.,

Here the Red Mud (containing Alumina, Tri calcium Silicate, Di Calcium Silicate, Tri Calcium Aluminate, Tetra Calcium Alumina Ferrite, Iron, SiO₂, Sodium Alumino Silicate) being used in place of Bauxite will reduce the consumption of certain raw materials added to the raw mix.

The Silica in Red Mud is almost reactive silica only. The caustic in the red mud reacts with the sulphur which is present in the coal and coke to form sodium sulphate.

There is a very high potential to use red mud as raw mix in cement making.

Outline of alternative materials usage in Japanese cement industry



Waste or byproducts emitted from various kinds of industries or municipalities are used effectively as cement raw materials.

**Now its time for Indian
Cement Industry to join
hands**

Thank You..