Smelter Audits

A New Perspective on Your Performance

In the competitive market of primary aluminium production, smelters are facing reduced profitability due to low aluminium price and high power prices. In this kind of environment smelter management needs to ask

- Are we making the most of what we have?
- Are all our assets being utilised to their full potential?
- Are our people focusing on what is important for the process?
- How do we make things better?

LMRC engineers work with smelters around the world, exposing them to the latest technology and best operational practices available. In addition, LMRC research has directly contributed to the development of new technologies that have been implemented globally in alumina refineries, potrooms, carbon plants and rodding rooms. This extensive experience gives LMRC the capability to examine a smelter's current performance and practices and recommend improvement pathways that meet the smelter's specific needs.

An audit conducted by LMRC is comprehensive and includes an assessment of:

- Overall smelter performance and KPI's
- Operational practices
- Use of data
- Decision making processes
- Thermal balance management
- Utilisation of equipment
- Management processes and efficiency
- Safety
- General physical condition of the plant

Pot performance is analysed using advanced statistical tools on current and historical data in conjunction with detailed observation of operational practices.

LMRC offers independent audits for potrooms, carbon plant, rodding room and the bath circuit.

Potroom Audit

The potroom audit provides detailed assessment of the current management structures, potroom and pot physical condition, control system and operations. Assessment includes the following items:

Table 1: Potroom audit list

Potroom management:	• Potroom management structure. • Man power requirements • KPI for potroom staff • Potroom operation • Potroom maintenance and logistics • Data management
Potroom and pot physical condition and design:	• General building condition and housekeeping • Pot superstructure • Bus work • Anode clamps/rods/stubs • Anode cover • Dust/air burn • Crust breaker/feeder condition • Tapping/Feeding hole • Pot heat balance assessment
Control Systems	• ACD control • Alumina feeding • Bath chemistry and temperature • Noise control • Data collection and analysis processes • Abnormality detection and response processes • Emission monitoring and control

Operational procedures:	• Anode change • Cover application and redressing • Metal tapping • Beam raising • Routine measurements – eg. bath & metal heights, metal and bath sampling and analysis • Liquid level management • Equipment management – eg. crane usage

LMRC engineers with smelter staff observe operational procedures and interview operators and managers in order to obtain the information required for correct assessment of the current potroom operation.

Carbon Plant and Rodding Room:

The performance of the smelter is also influenced by the quality of the anode assemblies, hence auditing the entire chain of anode production from raw materials to rodding room will lead to further improvement in terms of energy consumption, carbon consumption and reduction in rework (such as unscheduled anode change). Table 2 shows the different stages in the anode production process and the items that are audited by the LMRC team.

The outcome of the audit will include recommendations and ways to improve the performance of the process and better utilisation of data, equipment and people. These recommendations can be implemented by the smelter engineers/operators or LMRC engineers can provide further support to the smelter.

Table 2: Carbon and anode production audit list

Pitch melting facility	• Pitch melting controls and operation • Paste plant controls and operation • Incoming calcined coke/melted pitch/butt fraction/fines • Dry Aggregate/mixer/paste
Paste Plant **Vibroformer**	• Paste temperatures - Pitch, mixer, cooler, anode • Observe vibroformer operation • Green anode observations - height (density)/appearance/temperature
Storage/ Calciner	• Green Coke and solid pitch storage area • Smelter strategy for unloading and segregation/blending • Calciner technology/operation • Sample points/frequency • Any analysis done onsite?
Sampling & Measurements	• Sampling points • Take measurements (process temperatures etc.)
Baking Furnace	• Baking furnace maintenance operations • Observe furnace operations such as loading and unloading, pit dressing, etc. • Equipment conditions and placement
Rodding Room	• Anode butt survey (eg. condition, cracks, airburn) • Rod/stub condition • Rodded anode condition/quality • Cast iron condition
Bath processing plant	• Anode butt cleaning • Storage • Crushing • Blending • Transport/delivery to potroom • Quality control of crushed bath

Bath Circuit

The anode cover material composition and height control the heat dissipation from the top of the pots. Adjustment of the anode cover is one of the critical factors to control the pot heat balance, hence having a bath processing plant that can deliver anode cover material according to needed specification is important to the plant performance.

Maintaining bath height also depends on the operation of the bath processing plant.

In the smelter audit, LMRC engineers also examine the operation of the bath processing plant according to the list shown in Table 3

Table 3: Bath processing circuit audit list.

Storage	• Storage method • Condition and cleanliness
Crushing	• Crushing equipment • Maintenance • Operation • Crushed bath particle size distribution • Magnetic separation and crushed bath purity
Blending	• Blending method • Equipment • Operation and maintenance • Blended material quality • Blended materials size distribution
Transport	• Transport method

Gas Treatment Centre (GTC)

Gas treatment centre's operation and performance is critical to fluoride emission control at the smelter. Gas collection, transport, scrubbing reactors processes and secondary alumina transport back to the pots all have influence on the smelter's emission control and cell mass balance and performance.

The GTC audits looks all aspects of scrubbing operations and performance, determines the shortcomings and impacts to the process and highlights improvement paths to eliminate and mitigate these impacts.

Table 4: GTC audit list.

Reactors	• Design • Operation • Maintenance • Blockages or leaks
Bags House	• Maintenance schedule • Bags condition
Conveying System	• Type of conveying system • Maintenance and operation • Inventory management and segregation
Air Ducting	• Condition and maintenance • Visible leaks

Audit outcome and savings

In the audit we identify the areas that can be improved and usually continues improvement work is generated following the audit recommendation.

The table below shows the benefits in few parameters that were achieved in two smelters after improvements projects that were done based on the audit analysis.

Parameter	Smelter A	Smelter B
Current Efficiency (%)	2.27	2.1
Energy Consumption (DC)	-0.2	-0.52
Gross Carbon Consumption	-46	-39
Net Carbon Consumption	-27	-26

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