

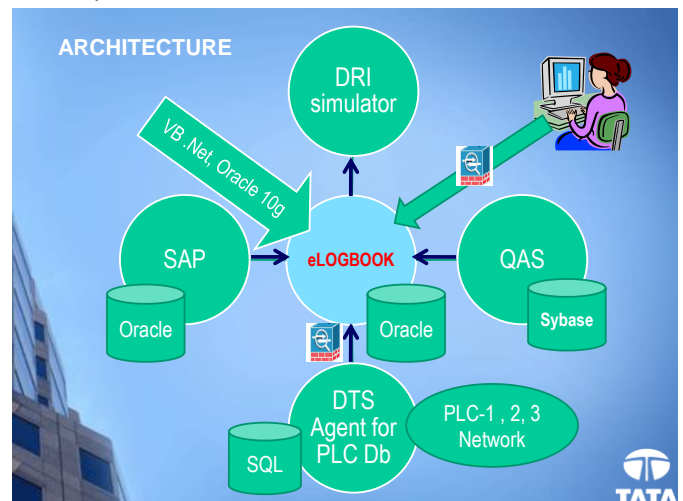
Coal based DRI often face problems of accretion, shorter campaign life, fluctuation in product quality, high coal consumption. The problem is compounded with deteriorating quality of coal and iron ore. The manufacturers, who do not have captive mines, source raw material (coal & ore ) from multiple sources with deteriorating and varying quality. The operator is faced with frequent changes in the input characteristics affecting process stability and is required to often manipulate large no. of parameters to maintain a stable process condition which is a very difficult task.

Typically DRI process involves measuring incoming raw materials ( coal , ore & dolo) characteristics for determining their suitability for operation. For day to day operational control, hourly samples are taken from circuits for coal and iron ore, and cooler discharge materials. Their characteristics are determined based on laboratory test and intimated to operator/process executives for taking necessary actions for controlling the process. In addition, other parameters such as temperature inside the kiln at different zones, air flow rates, kiln rpm, ore and coal flow rates, finished product output, gas volumes and temperature at different zones, operating conditions of critical equipment and auxiliary systems, etc are measured. Traditionally, these were recorded in manual log sheets not amenable to quick analysis and decisions for better process control.

In later period, SCADA workstations were installed and operating conditions like temperature, pressure, air flow, material flow rates, equipment conditions were captured using PLC systems. To **manipulate** these conditions, the process operator/executive needed analysis and trends of other interrelated input and output characteristics such as raw material and product characteristics which was not normally possible with data recorded in manual log sheets. Over 200 variables and 2000 observations are captured per kiln every day. It is obvious that process operators find it difficult to control the process in their day to day operations.

At best when the process goes out of control, normally the process-in-charge takes decisions based on his experience and often by trial and error method. Hardly, the operator could take decision. With deteriorating raw material quality and multiple sources of varying quality the process goes out of control most often. The results are shorter campaign life, frequent shutdown, higher raw material consumption and firefighting operation with low operator morale.

To improve this situation Tata Sponge adopted Information Technology and used it effectively to manage its DRI operation. It has implemented an in-house designed s/w application named eLOGBOOK (Electronic logbook) which captures all data from laboratory analysis, PLC systems, and SAP ERP application into a single repository. It provides information including trends, correlated trends and critical process parameters on-line to the operator for better process control.



The application has following features.

- On-line information for operators & executives.
- Access available over Office & Residential network
- User friendly **165 queries, 111 trend charts**
- Data export to EXCEL and statistical package
- Interface to offline mathematical model – simulator for DRI process
- Data repository over 10 years
- Application Security at network level through firewall

The application enables the operator and process executives to control the process by providing on-line information and trends on several process parameters. Some of the important ones are given below.

**Raw Material Quality :** The Quality Assurance conducts hourly tests of circuit raw materials such as coal and iron ore and captures them in SAP which are available in eLogbook on-line. Data such as size analysis , % of fines, and Fe for ore; and % fines in feed coal, proximate analysis of coal are available on-line for the operator to know quality of raw material being fed into the kiln.

**Shell Temperature :** The application provides a graphical view of relative build up of accretion inside the kiln using the shell temperature profile. It is analyzed everyday in the morning meeting. Necessary input parameters such as air and feed rate are manipulated to control to control temperature and accretion build-up.

**C/Fe Ratio :** Maintaining optimized reducing atmosphere inside the kiln is critical to operation. For this the operator / process executive monitor trend of C/Fe ratio inside the kiln provided by eLogbook. The trend is available hourly, and for a period as shown below.

**Variation in Product Quality (FeM) :**

Quality Assurance conducts hourly analysis of product samples. The results such as metallization, Fe(M), non-magnetic, FC in char, etc are captured in SAP and available on-line to the operators. In case the conditions are outside the control limits, input parameters are manipulated to bring control.

These are but a few examples. There are 111 trends available on-line on various parameters. Tata Sponge and TCS have jointly developed a mathematical model, an off-line simulator for DRI process. The model is used off-line to study the impact of changes in input parameters such as raw material and air on the product quality and helps the operator to take correct decision. The model uses 85 data input. The ELBK is integrated with mathematical model to facilitate quick data input without manual effort.

eLOGBOOK has been implemented for all the 3 kilns and is extensively used by the operator/operating executives as well as executives in Quality Assurance and Raw material department for analysis and decision making. ELBK has enabled operating group to improve their operating practices so as to achieve consistent product quality, longer campaign life, lower raw material consumption.

The accessibility to this application over network and its rich source of data makes it a powerful tool for helping analytical culture in the organization. Tata Sponge has been received **CII IT Awarded for 2009-10** from CII Orissa chapter for successful implementation and use of eLOGBOOK application in the organization.