CHAPTER 2.3

Mill Reports

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The primary objective of mill reports is to provide plant, senior, and corporate management with an ongoing status of plant operations in respect to historical performance, predicted performance, and a road map for future improvements. The type of reports prepared by mill staff may include daily, monthly, and yearly reports metallurgical test work reports; capital project reports; and general cost reports.

Generally, comprehensive daily mill data are entered into a database or spreadsheets and then reviewed by metallurgists for the individual unit operations. Data from this database are summarized for management, namely, tons treated, head grades, recovery, and metal production. These data are compiled and used to prepare monthly and annual mill reports by metallurgical staff. There are no standard formats established by the mining industry. The data compiled for mill reports are influenced by the size of the operation, desire of corporate management, and the complexity of the operation. A monthly report prepared for a 400-t/d (metric tons per day) operation may be significantly different from one prepared for 40,000 t/d.

The advancement in instrumentation and information technology has enhanced the compilation of data. Prior to recent developments in technology, data were compiled by hand in log books and then transferred manually into metallurgical reporting software. This has now changed with real-time data often being transferred directly from process control software into an operation's metallurgical database.

The type of data gathered in a site database on a daily basis is given in Table 1. This information is reviewed daily to keep track of the performance of the mill. Very often, mill staff use computers to generate graphs showing relationships between different process parameters.

The general format for monthly or annual mill reports is given in Table 2. The major topics are briefly discussed in the following sections.

SAFETY

Safety is generally the first item discussed in the mill report. The number of accidents that occurred and injuries recorded during the reporting period are provided in this section. A brief description of each incident is discussed, and the control measures that were identified or implemented to prevent similar occurrences in the future are presented. The management will also report the number of workplace inspections, safety observations, hazard identifications noted, and any training and refresher courses provided.

Table 1 Partial list of daily data collected by mill personnel

Feed rate	Power consumption
Percent moisture	Reagent mixing and inventories
Pulp densities	Labor reports
Particle size monitoring	Abrasion, sickness, vacations
pH	Reagent consumption
Assays	Grinding media used
Concentrate shipped	Metallurgical logs
Concentrate on hand	Safety report
Production calculations	Water and tailing management report
Operating hours	Processing cost breakdown
Reasons for lost time	

Table 2 Outline of a typical monthly or annual mill report

1. Safety
2. Mill production summary
3. Processing plant
   a. Crushing
   b. Grinding and classification
   c. Concentrate handling/packaging or gold production
   d. Tailings pond
   e. Laboratory
   f. Metallurgical balance
4. Maintenance
   a. Summary
   b. Preventive maintenance
   c. Workforce
5. Capital projects
6. Cost summary totals
   a. Cost and production—actual vs. budgets
   b. Major cost variances

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Most of the operations will paraphrase the information. However, some operations may report the information in a table with a typical format, such as illustrated in Table 3. A detailed discussion about the reasons for the compilation of the information is provided in Chapter 2.1, "Health and Safety."

MILL PRODUCTION SUMMARY

This section usually provides production data for the month. It could be a few sentences stating the tons of concentrate produced and/or the ounces of precious metals produced during the month or detailed tables, as shown in Tables 4 and 5, with in-depth discussion providing the highlights of issues encountered and the reasons for the variance between budgeted and actual production. Table 5 is typical of a three-stage crushing ball mill circuit for a flotation plant. Many of the comminution circuits today are primary crush followed by an SABC (i.e., semiautogenous, ball mill, and pebble crusher) configuration.

PROCESSING PLANT

This section provides a more detailed discussion of production achieved during the month as well as any reasons for variance of targets for the month.

The discussion will generally follow the plant flow sheet, starting with crusher circuit performance and leading into the grinding circuit. Depending on the plant flow sheet, the performance of other unit operations (flotation, thickening, filtration, leach, solvent extraction electrowinning, etc.) will also be discussed in detail.

Very often the tailings pond is under the environmental group. However, the mill report should discuss the status of the tailings and detoxified leach residue, including the mitigation efforts to ensure that tailings are benign.

The report may also include a table summarizing reagent consumption on a total and per-ton basis. Actual consumptions will be compared against budget figures with the reasons for any variance being discussed. The reasons for variance could be due to less or more tonnage processed; harder ore, which resulted in higher media consumption; or higher feed grade, which requires more flotation reagents.

Laboratory activities are generally directed at working on projects to improve plant metallurgy and reduce costs (e.g., to evaluate cheaper alternative reagents). A summary of these activities should highlight the results achieved during the reporting period. Additionally, the laboratory personnel undertake plant sampling, testing reagents, or pilot new equipment. These activities are also reviewed in the mill report.

Metallurgical staff prepare a daily metallurgical balance. These data are accumulated and the monthly and year-to-date metallurgical balances are calculated and reported in this section. When the flotation plant produces more than one concentrate, as in polymetallic processing plants, the methodology used for metallurgical balance is also discussed in the report. A detailed discussion on the metallurgical balances is provided in Chapter 2.4, "Metal Accounting." However, the monthly report will highlight the outcome of the monthly metallurgical accounting with commentary if there are issues and what is being done to rectify them.

MAINTENANCE

The maintenance section presents a brief summary of both the major work completed and major downtime recorded during the reporting period. Some operations break down their activities and time spent for the different areas and/or types, namely, unit operations or mechanical, electrical, and miscellaneous activities. Typical formats are shown in Tables 6 and 7.

The preventive maintenance scheduled for the following month is also reported in the monthly report. Very often, the tables will report the availability and utilization of the equipment. Availability is the number of hours the equipment can be operated, whereas the utilization is the number of hours the equipment was operated divided by the number of hours the equipment was available for operation.

Table 3 Typical data in a safety report table

Item	Month	Year to Date	Last Year
Active number of employees			
Total worker-hours			
Lost-time accident (LTA) Medical accident (MED) First-aid accident			
Incidence rate LTA Incidence rate MED Incidence rate all accidents			
Days without LTA			
Off-the-job accidents Off-the-job days lost			

Table 4 Typical monthly mill production table for gold operation

	Month			Year to Date		
Process Parameters	Actual	Budget	Variance	Actual	Budget	Variance
Crusher throughput, dmt (dry metric tons)						
Crusher throughput rate, t/h						
Crusher operator time, %						
Mill throughput, dmt						
Mill throughput rate, t/h						
Crusher throughput time, %						
Gold head grade, g/t Au						
Gold recovery, %						
Combined tail grade, g/t Au						
Gold poured, oz						

Table 5 Typical monthly mill production table for three-stage crushing ball mill comminution followed by flotation plant

	Month			Year to Date		
Process Parameters	**Actual**	**Budget**	**Variance**	**Actual**	**Budget**	**Variance**
Primary crushing plant						
Cars dumped, no.						
Operating time, h						
Crushed, dmt						
Secondary crushing plant						
Operating time, h						
No. 1: standard						
No. 1: short-head						
No. 2: short-head						
Product						
Crushed (weightometer), wet t						
Moisture, %						
Crushed, dmt						
Grade, % metal						
Grinding						
Ball mill						
Feed, wet t						
Moisture, %						
Operating time, h						
Feed, dmt/h						
Flotation						
Grind P_{80}, mesh						
Feed grade, % metal						
Rougher concentrate						
Recovery, wt %						
Recovery, % metal						
Final concentrate						
Recovery, wt %						
Recovery, % metal						
Grade, % metal						
Concentrate stockpiled, t						
Concentrate shipped, t						

Table 6 Breakdown of worker-hours by category for maintenance

Category	%	Actual	Year to Date
Actual worker-hours worked			
Budget worker-hours			
Hours in backlog			
Work requests received (mechanical)			
Work requests received (electrical)			
Work requests received (miscellaneous)			
Work requests completed (mechanical)			
Work requests completed (electrical)			
Work requests completed (miscellaneous)			
Total work requests completed			
Worker-hours for planned repairs (ppm running)			
Worker-hours for breakdowns			
Worker-hours for modifications			
Worker-hours for corrective action			
Worker-hours for fabrication			
Worker-hours for crane service			
Worker-hours for shutdowns			
Worker-hours for safety			
Operator damage			
Miscellaneous			
Mechanical availability			
Electrical availability			

Table 7 Breakdown of maintenance worker-hours by unit operation

Unit Operation	%	Hours	Year to Date
Primary crushing			
Course ore reclaim			
Secondary crushing			
Tertiary crushing			
Conveyors			
Dust suppression			
Agglomeration			
Leach pad spray system			
Wet plant and gold room			
Auxiliary power generation			
Potable water			
Process water			
Light vehicles			
Maintenance workshop			
Laboratory			
Administration			
Exploration			
Miscellaneous			

Table 8 Operating cost summary

Unit Operation	Month			Year to Date			Comments
	Actual	Budget	Variance	Actual	Budget	Variance	
Crushing							
Grinding							
Flotation							
Thickening							
Filtration							
Tailings							
Technical services							
Supervision and overhead							
Total							

Table 9 Summary of milling costs

Account	This Month		Year to Date	
	Total	Cost, $/t Milled	Total	Cost, $/t Milled
Operation				
Labor				
Supplies				
Power				
Other				
Total operations				
Maintenance				
Labor				
Supplies				
Power				
Other				
Total maintenance				
Total direct milling costs				
Indirect costs				
General expense				
Net vacation allowances				
Net holiday allowances				
Pension accruals				
Taxes				
Insurance				
Salaries				
Miscellaneous maintenance				
Receiving and buying				
Shipping and selling				
Safety and welfare				
Total indirect costs				
Total operating costs				
Cost of ore milled				

CAPITAL PROJECTS

If the plant has ongoing modifications to improve the operation, the mill report will provide a summary of the status of these capital projects. The summary will include the work completed and ongoing costs.

COST SUMMARY TOTALS

The cost summary section presents the cost breakdown by area for the month and year to date. A brief description of the reasons for the variance between the actual and budget costs is also generally given. Typical tables for the cost summary are given in Tables 8 and 9. Many operations will report their costs as shown in Table 9.

MISCELLANEOUS REPORTS

Metallurgical staff will also prepare reports on development test work directed at enhancing plant performance and/or reducing operating costs.

Management may also require mill staff to prepare reports on capital cost projects, detailing the modifications in the plant, the reasons for doing so, and the projected benefits that are anticipated.