10.12 Ongoing Performance Analysis

Ongoing performance analysis is conducted to assure that issues and adverse trends are identified and corrected before they become significant systemic, programmatic or recurring issues. This analysis also is used to gauge sustained performance and identify improvement areas. Ongoing performance analysis involves using both qualitative and quantitative methods to track, monitor, trend, and analyze data to gauge performance. The process for ongoing performance analysis is:
1. Identify the performance area(s) to monitor or measure.
2. Define the data to collect.
3. Identify and document the source(s) to obtain the data (Refer to the Performance Area and Data Sources section below).
4. Develop and document the performance analysis methodology (Refer to the Performance Analysis Methodologies section below).
5. Determine the monitoring and reporting frequencies (for example, daily, weekly, monthly, quarterly, etc.; the common frequencies are monthly or quarterly to get meaningful information for assurance and continuous improvement.)
6. Establish targets, performance indicators, or thresholds/control limits to gauge performance, where applicable.
7. Collect and analyze the data.
8. Consult with appropriate SMEs/management for information on and/or explanation of identified variations (positive or adverse).
9. Report findings and observations to management for resolution.
10. Correct adverse issues and trends.

Performance Area and Data Sources

Divisions are responsible for tracking issues (regardless of reportability), actual and near miss incidents, assessment findings and other unexpected adverse events to identify trends and recurring issues. Before selecting the data source(s), Divisions should identify the specific condition, event, program, process, behavior or quality-related characteristic to be monitored, measured and/or controlled. Once the performance area is identified, there are many sources of data. Below is a list of the common sources (this list is not inclusive):

- ORPS Reportable Incidents
- Sub-ORPS Incidents
- PAAA Reportable Incidents
- Regulatory Findings
- Assessment / Audit Findings
- Safety Concerns
- Division-specific incident logs
- Field Observation/Walkaround inspection logs or worksheets
- Stand-downs / Stop works
- CATS Database entries
- CHESS injuries entries
Lessons Learned Database submissions
Metric Results
Risk Registry
Operations Quad Charts

To select the appropriate data source for a given performance area, the rule of thumb is to use a data source that is:
- **Credible** – is a measurable source rather than based on anecdotal/subjective information.
- **Timely** – is available on the periodicity required to evaluate the performance area effectively.
- **Reliable** – is a proven, sustainable and cost effective method to collect data.
- **Easy to obtain/retrieve** – is readily accessible with no (or little) administrative burden.
- **Recognized and understood by management** – is a familiar and relevant data source that management views as important.
- **Comparable over time** – has sufficient historical data to develop baselines and trends, and to assess past and present performance from period to period.

**Performance Analysis Methodologies**

Performance Analysis methodologies may include qualitative analysis, trend charting, and analyzing performance metrics (which may include error precursors). The methodology should be robust enough to:
- Identify changes in performance (upward, stable or downward trends).
- Ensure performance is within specified limits/tolerances.
- Identify opportunities for improvement.
- Determine the effects of improvement efforts on performance.

**Qualitative Analysis**

Qualitative Analysis, generally, is based on non-quantifiable data. Qualitative data, such as surveys, logbook entries, processes/field observations, incident summaries, causal analysis, and personnel interviews must be interpreted carefully and thoroughly analyzed through fact-based reasoning. To perform this analysis, qualitative data often is converted to quantitative data, for example, numerical values, categories or trend codes. Once the data is in quantitative or an absolute form, it can be aggregated and analyzed.

Assigning trend codes to qualitative data is commonly used at LBNL to facilitate trending and analysis, and the identification of systemic and recurring issues. In general, a trend code represents the most probable cause of an issue. The trend codes assigned to issues in the CATS database can be used to trend and analyze issues. Appendix A contains a list of common trend codes that are consistent with ORPS cause codes and common cause areas.
**Trend Charting (Trend Charts)**

Trend Charts are used to monitor performance over time to detect trends, variations and issues. Trend Charts display patterns in a simple, visible and easy to understand format, and make it easy to identify issues and improvements.

There are several basic types of trend charts, such as Control Charts, Run Charts and Pareto Charts, that can be used to identify variations in performance, understand the magnitude and sources of variations, and anticipate future performance. Runs Charts and Pareto Charts are easier to produce and simple to interpret. Control charts require more knowledge and special calculations. Consult with management, OIAI personnel and/or a Laboratory statistician to assist with selecting the appropriate chart(s) for ongoing performance analysis. Below is a description and example of each trend chart.

- **Control Chart**

  The Control Chart is useful to identify variations and their sources over time. The Control Chart can be used to determine whether a value is within an acceptable statistical threshold and if a statistical trend is present. The control chart also plots a single line of data over time and can identify whether a performance area is stable and in control.

  A Control Chart has a baseline, average or performance mean, and usually has both an upper control limit (UCL) and a lower control limit (LCL). There are many types of Control Charts and different methods of calculating the performance mean and control limits. Generally, at least 25 data points are required to determine the performance mean and control limits. When control limits are calculated, data points that are outliers generally are excluded from the calculations. Below is an example of a Control Chart.

![Control Chart Example](image-url)
Below are the various types of Control Charts. The type of data being charted determines the type of Control Chart that should be used.

<table>
<thead>
<tr>
<th>Type of Data</th>
<th>Type of Chart</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable*</td>
<td>X chart</td>
<td>To plot percentages, ratios, counts and other non-measurement data</td>
</tr>
<tr>
<td>Variable</td>
<td>R chart</td>
<td>To plot the sample ranges</td>
</tr>
<tr>
<td>Variable</td>
<td>S chart</td>
<td>To plot the sample standard deviations</td>
</tr>
<tr>
<td>Variable</td>
<td>0 chart</td>
<td>To plot the sample means</td>
</tr>
<tr>
<td>Attribute**</td>
<td>C chart</td>
<td>To plot the number of deficiencies if the distribution of failures is rare (constant sample size).</td>
</tr>
<tr>
<td>Attribute</td>
<td>U chart</td>
<td>To plot the number of deficiencies if the distribution of failures is rare (variable sample size).</td>
</tr>
<tr>
<td>Attribute</td>
<td>Np chart</td>
<td>To plot the number of deficiencies if the distribution of failures is not considered rare.</td>
</tr>
<tr>
<td>Attribute</td>
<td>P chart</td>
<td>To plot the percent of deficiencies.</td>
</tr>
</tbody>
</table>

* Variable = measured and plotted on a continuous scale (time, cost, etc.)

** Attribute = counted and plotted as discrete events (errors, occurrences, etc.)

- **Run Chart**

The Run Chart is used to track and analyze trends or patterns over a specified period. This chart assists with detecting statistical trends, shifts or cycles. A Run Chart consists of a single line plotting data points in time sequence and may contain a centerline, which is the mean or median. A Run Chart can help identify upward, downward and stable trends over time. Below is an example of a Run Chart.
- **Pareto Chart**

The Pareto Chart is used to identify aspects of performance, such as causes, errors or non-compliance. A Pareto Chart shows the relative frequency and size of the performance element to focus attention and effort on fixing significant issues and adverse trends. Below is an example of a Pareto Chart.

![Number of Incidents by Trend Code](image)

**Key:**
- NI = Needs Improvement
- LTA = Less than adequate

### Determining Trends

Numerous criteria can be applied to identify trends and other changes using trend charts. The following criteria can be used to determine positive, stable or adverse trends, statistical trends, shifts and outliers based on data points or patterns.

**A trend may exist if there is:**
- a noticeable change in performance, such as upward or downward movement; or
- a series of consecutive increases or decreases.

**A statistical trend is defined as:**
- one point outside the control limits;
• two out of three points two standard deviations above or below the baseline average;
• four out of five points one standard deviation above or below the baseline average;
• seven points in a row above or below the baseline average; or
• seven points in a row that are increasing or decreasing.

**A shift may exist if:**
• seven points in a row are above or below the average; or
• four out of five points are one standard deviation above or below the average.

**An Outlier (or Outliers) may exist if:**
• one point is outside the control limits; or
• two out of three points are two standard deviations above or below the average.

**Performance Metrics**

Performance Metrics are used to evaluate progress toward stated performance goals or targets, evaluate identified risk exposure/vulnerabilities, and to proactively identify emerging risks and recurring issues. The rule of thumb is to develop and track a performance metric that:
• has a defined target/goal (acceptable range), cautionary, and warning level, and an escalation trigger to prompt line, division or senior management action;
• is easily quantifiable as a number, percentage, amount, etc.;
• reflects an objective measurement rather than subjective judgment; and
• is comparable over time for trend analysis and benchmarking.

There should be a balance of leading and lagging metrics when evaluating a particular performance area. Depending on perspective, a given metric can be leading or lagging. Management will need to determine whether a metric is leading or lagging, and determine the appropriate balance of metrics to evaluate a performance area. Below is a general characterization of leading and lagging metrics:
- A **leading** metric signals future events and anticipates and predicts patterns or trends (precursors – indicates a future direction).
- A **lagging** metric confirms that a pattern exists or is about to occur (trailing – indicates achievement of goals).

Below is a general process flow to develop and manage performance metrics.
Corrective and Improvement Actions

When issues and adverse trends are identified through ongoing performance analysis, corrective action should be taken to address the issues or adverse trends per the Issues Management Program requirements. Similarly, when there is a desire to strengthen performance, improvement actions should be initiated to obtain the desired performance.

Occasionally, ongoing performance analysis also may identify a need to modify targets, goals and/or control limits. To determine if modification is necessary, consider the following:

- Was there a significant change to a policy, process, procedure or other activity?
- Is the performance stable/sustained?
- Is the cause of the change understood and can be addressed?

If the answer is “yes” to any of the questions, then a target, goal or control limit may warrant an adjustment.