EFCOG Best Practice #139

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Best Practice Title: Development and Use of ORPS Program Performance Indicators

Facility: The idea for this document originated during the Energy Facility Contractor Group (EFCOG) ORPS Task Group Meetings held from November 30 to December 2, 2010 at the DOE/NNSA Nevada Support Facility in Las Vegas, Nevada. The document is a collaborative effort between all members of the EFCOG ORPS Task Group, which includes contractors from Sandia National Laboratory (SNL), Lawrence Livermore National Laboratory (LLNL), Lawrence Berkeley National Laboratory (LBNL), Savannah River Site (SRS), Hanford Site, Y12 National Security Complex (Y12), Oak Ridge National Laboratory (ORNL), East Tennessee Technology Park (ETTP), Pantex Plant (PANTEX), Paducah Gaseous Diffusion Plant (PADUCAH), Los Alamos National Laboratory (LANL), Brookhaven National Laboratory (BNL), Idaho National Laboratory (INL), Waste Isolation Pilot Plant (WIPP), Pacific Northwest National Laboratory (PNNL), Nevada National Security Site, and DOE-HQ HSS.

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Brief Description of Best Practice:

This best practice provides general guidance on developing and using metrics to monitor the performance of a site's occurrence reporting and investigation program (henceforth, ORPS Program). The guidance describes an approach for developing ORPS program metrics and a suggested suite of performance indicators that will be broadly applicable across all sites and will contribute to effective operations management and oversight by measuring the critical success factors of the ORPS Program.

Why the best practice was used:

The EFCOG ORPS Task Group formed this best practice with the following focus in mind, "I'll know I have a successful ORPS Program when…" In answering, the group did not emphasize rote compliance with the various timelines associated with the Order, which has been the general tendency in the past. Rather, the team focused on whether DOE and the Contractors were meeting the intent of the Order, which led to developing the following four critical success factors:

1. **Culture**: A successful ORPS Program fosters an environment of open reporting and timely categorization.
2. **Process**: A successful ORPS Program ensures effective and timely communication of ORPS events.
3. **Quality**: A successful ORPS Program conducts high quality causal analyses and develops effective corrective actions.
4. **Learning**: A successful ORPS Program helps to reduce the severity and frequency of adverse events.

Note that the critical success factors align with four themes that are important to the success of any ORPS program: culture, process, quality, and learning. These critical

success factors and the associated themes formed the basis for the development of all associated performance indicators.

What are the benefits of the best practice:

The development of a balanced ORPS Program Metrics hierarchy of critical success factors linking desired outcomes with necessary and sufficient actionable measures will serve as leading indicators of the site's occurrence reporting and investigation program's health.

What problems/issues were associated with the best practice:

The only real problem associated with the best practice is that each site must have data streams that can feed the metrics. Without the data streams, it will be difficult to create and maintain a comprehensive set of metrics. However, many of the metrics outlined in the best practice are based on data that comes directly from the ORPS data base, therefore the data for the metrics is relatively easy to obtain. Other key data streams for some of the important metrics are based on the development of checklists that help quantify, for example, ORPS program elements associated with the quality of causal analysis and corrective actions. It is important to have these checklists to obtain the data necessary to populate some of the metrics.

How the success of the Best Practice was measured:

Data and operating experience are fully described in the attached guidance. Many sites have begun to use elements of the metrics hierarchy for monitoring ORPS Program performance. These metrics have been helpful to convey overall ORPS Program performance to both the contractor and site office.

Description of process experience using the Best Practice:

There are three main purposes of any ORPS Program; 1) timely and accurate notification to DOE of significant abnormal events, near misses, or management concerns, 2) analysis and correction of the factors that caused the abnormal event, and 3) local and DOE-complex – wide dissemination of associated lessons learned. Given the pivotal role the ORPS program plays in working to improve environment, safety, health and nuclear safety performance at any site, it is important to have a comprehensive and balanced set of ORPS Program performance metrics. This is fully detailed in the attached guidance. In summary, the major point of the best practice is that it is important to establish a hierarchy of critical success factors that link the desired outcome of improved ORPS Program performance with necessary and sufficient actionable measures. This was the basic process used by the ORPS Task Group in developing the best practice.

Additional Information Reference: EFCOG Guidance Document: Development and Use of ORPS Program Performance Indicators

EFCOG Best Practice: Development and Use of ORPS Program Performance Indicators

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Introduction

This document provides general guidance on developing and using metrics to monitor the performance of a site's occurrence reporting and investigation program (henceforth, ORPS Program). The guidance describes an approach for developing ORPS program metrics and a suggested suite of performance indicators that will be broadly applicable across all sites and will contribute to effective operations management and oversight.

The idea for this document originated during the Energy Facility Contractor Group (EFCOG) ORPS Task Group Meetings held from November 30 to December 2, 2010 at the DOE/NNSA Nevada Support Facility in Las Vegas, Nevada. The document is a collaborative effort between all members of the EFCOG ORPS Task Group, which includes Sandia National Laboratory (SNL), Lawrence Livermore National Laboratory (LLNL), Lawrence Berkeley National Laboratory (LBNL), Savannah River Site (SRS), Hanford Site, Y12 National Security Complex (Y12), Oak Ridge National Laboratory (ORNL), East Tennessee Technology Park (ETTP), Pantex Plant (PANTEX), Paducah Gaseous Diffusion Plant (PADUCAH), Los Alamos National Laboratory (LANL), Brookhaven National Laboratory (BNL), Idaho National Laboratory (INL), Waste Isolation Pilot Plant (WIPP), Pacific Northwest National Laboratory (PNNL), Nevada National Security Site, and DOE-HQ HSS.

Outcome Measures and Leading Indicators Discussion

Leading indicators point to specific outcomes. We want a safer operation, a more reliable piece of equipment, a speedier service, or a more effective process, and so we identify and measure factors that we believe are likely to influence or affect those outcomes. In other words, a search for leading indicators is a search for "knobs that we can turn—and real-time feedback for the knobs that we ***decide*** to turn." The following discussion provides a simple illustration of the basic concepts behind how to search for the knobs that are connected to the desired outcome.

One outcome metric we have all monitored is body weight. We have noticed over time that this number seems to spontaneously rise and fall, especially after vacation, and we wonder if we will ever be able to control it. We are surprised when simply staring at the scale each day seems to have no affect on the outcome.

So, what do we do now, just keep staring at the scale and hope that something good happens? No, we have to identify those parameters that seem to affect the outcome; namely, the "critical success factors" that influence the performance. You can begin to identify these critical success factors by asking yourself a simple question, "I know I can control my weight when…", and then try to fill in the blanks. Thinking for a minute or two, we come up with two possible critical success factors, caloric intake and exercise. We would then see if loading these critical success factors into the blanks answers the question, "I know that I can control my weight when I ***monitor and control my calorie intake and get regular exercise***." These critical success factors seem to fit pretty well.

Now that you have come up with these two critical success factors, you need to ask whether they are "actionable". If not, you continue to cascade down the critical success factor hierarchy until you arrive at something that is actionable. Fortunately, the two we came up with are actionable, which means both of these critical success factors magically transformed into leading indicators! The next step is to set

reasonably achievable targets and performance ranges for both the leading indicators and the desired outcome and you have started down the path of managing with metrics. For our simple example, we will target lowering the outcome measure by 10 pounds, which in turn leads to a target for the daily caloric intake of 1700 calories, and an exercise target of walking 20 minutes every other day. We will monitor this performance for 3 months while diligently staying within our leading indicator targets, and at the end of the time-period, see if our set of metrics has allowed us to meet our weight loss objective. Of course, this is a simple example, and in real life, we would consider other, relatively fixed factors when establishing performance targets and monitoring periods, such as initial weight, age, height, gender, etc. The illustration demonstrates the point of how to find and manage with actionable indicators.

When developing critical success factors and leading indicators, you should also keep in mind the rule of "necessary and sufficient". Although there are many things that you could measure and try to manage, only a few will really affect the outcome. These few things are the "necessary and sufficient" set of metrics. Everything else will just confuse the issue. In the above illustration, we could have also decided to track our waist size and daily coffee consumption, but these would not have been necessary or sufficient to affect the desired outcome. All you really needed to monitor and manage were daily caloric intake and exercise.

It is important to take a moment to talk about weighting of performance metrics. Weighting is assigned to metrics according to the importance of any given metric to the overall outcome. In our illustration, we had two indicators, caloric intake and exercise. From experience, it should be clear that it takes an awful lot of vigorous exercise to burn an appreciable amount of calories. For light to moderate exercise then, if we continually take in more calories than we need, we have no hope of managing our weight. Although it is important to manage both indicators, it is more important to monitor and manage caloric intake. From a weighting standpoint then, we might place a weighting of 70% on caloric intake and 30% on exercise, for a total weighting of 100%.

From this illustration, it should be clear that the outcome, or lagging indicator, is just as important as the leading indicators, for without the desired outcome, the leading indicators have no context. It also should be clear that outcome measures are likely themselves leading indicators from a different outcome perspective. For example, your body weight, which many consider a "lagging indicator", is only one of many leading indicators of overall health.

In summary, the important thing to remember when developing metrics is that you need to establish a hierarchy of critical success factors that link desired outcomes with necessary and sufficient actionable measures. This was the basic process used by the ORPS Task group in developing the ORPS Program metrics. The remainder of this document will focus on establishing this hierarchy for ORPS program performance.

ORPS Program Critical Success Factors

As mentioned above, the first stage in metrics development is determining the desired outcome or outcomes. If starting with a clean slate, this would involve understanding such things as the general purpose of an organization, customer and stakeholder expectations, and contractual commitments. For this document, the overall desired outcome is an effective ORPS Program. From a larger perspective, the Task Group (or team) then asked the question, "I'll know I have an effective ORPS Program when…" and then set out to start answering this question and building critical success factors. Again, from a larger perspective, the team answered that a successful ORPS Program would enable effective mission delivery, help ensure a safe and environmentally responsible workplace, and be cost effective. These overarching critical success factors serve as a cornerstone for all site operations and as such, should serve as the basis

for organizational metrics. The team concluded that for the purposes of ORPS Program metric development and this document, ORPS Program performance generally fit best within the critical success factor of a safe and environmentally responsible workplace. Again, each site should have a suite of metrics that are targeted at demonstrating performance for different aspects of the environment, safety, and health program, so the team focused effort on metrics centered on the individual elements of ORPS Program execution.

With this more narrow focus in mind, the team then re-asked the question, "I'll know I have a successful ORPS Program when…" In answering, the team did not emphasize rote compliance with the various timelines associated with the Order, which has been the general tendency in the past. Rather, the team focused on whether DOE and the Contractors were meeting the intent of the Order, which led to developing the following four critical success factors, all with equal weight of 25%:

1. **Culture**: A successful ORPS Program fosters an environment of open reporting and timely categorization.

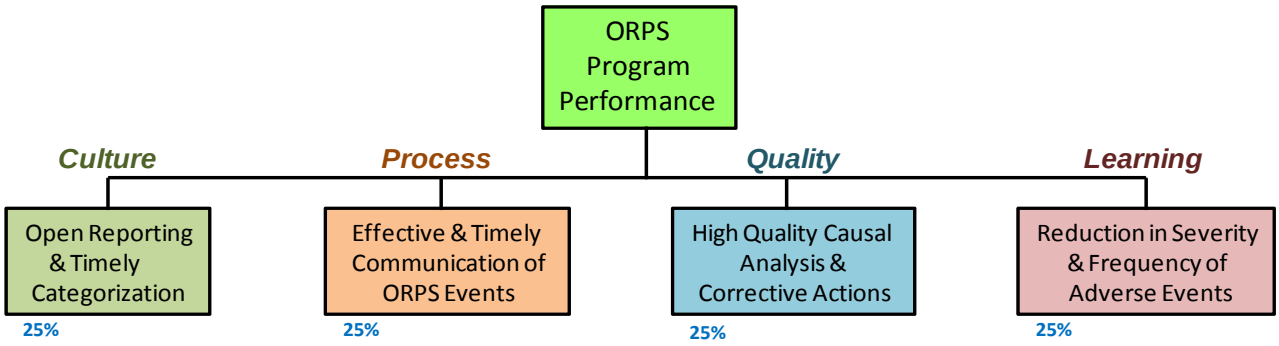
2. **Process**: A successful ORPS Program ensures effective and timely communication of ORPS events.

3. **Quality**: A successful ORPS Program conducts high quality causal analysis and develops effective corrective actions.

4. **Learning**: A successful ORPS Program helps to reduce the severity and frequency of adverse events.

Note that the critical success factors align with four themes that are important to the success of any ORPS program: culture, process, quality, and learning. These critical success factors and the associated themes formed the basis for the development of underlying indicators.

The following figure displays the top tier of the ORPS Program critical success factors hierarchy:



Note that the first three critical success factors in this top tier are not yet measurable or actionable. At this point, the team focused on "drilling down" to identify leading indicators for these first three critical success factors. It is important to note that when the team developed this drill down, they were conscious of the amount of work that might be required by each site to gather data. Consequently, there was a concerted effort to identify metrics for which most sites already had, or could readily obtain, data. The fourth critical success factor in the tier is also an outcome measure and is discussed on pages 12 and 13 below.

ORPS Indicators

Culture: Open Reporting & Timely Categorization

This is the critical success factor related to "Culture". By culture, the team meant that a given site openly and transparently reported and managed all events, regardless of whether they were reportable via ORPS. How do you measure this culture? The team considered a number of options, but wound up with two actionable indicators that could monitor culture.

1. **Sub ORPS Ratio:**

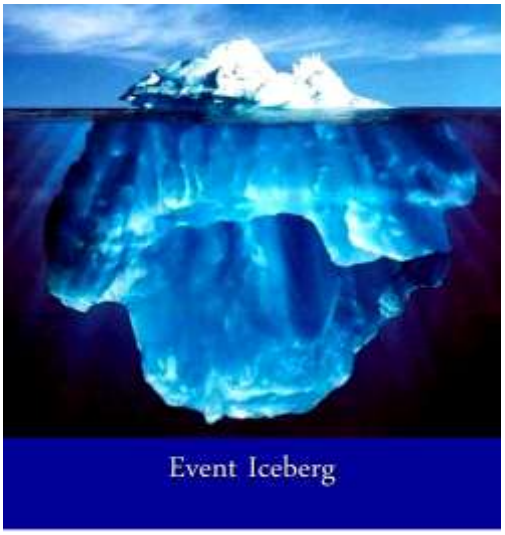
   The Total Number of Sub-ORPS events / Total Number of ORPS events. The time-period for this data would typically be a month or a quarter.

2. **Percent of Total ORPS Events Categorized within Two Hours of Discovery,** which is defined as follows:

   ((Total ORPS Events – Number of ORPS Events Categorized > 2 hours from Discovery) / Total ORPS Events) X 100%

Sub-ORPS Ratio

The thought behind this metric was based on the notion of the so-called "Event Iceberg". Recall the basic premise of the Event Iceberg; for every one ORPS event that is outwardly visible, or *above* the waterline, there are a larger number of precursor events that are inwardly visible, or *below* the waterline. The assumption is that in an open reporting culture, you should have a larger number of precursor or "sub-ORPS" events for every single ORPS event. Measuring this ratio is therefore a very useful indicator of culture. How is this measure actionable? The idea is that if the ratio is "too low", management could take any number of actions to encourage more open reporting. This might include establishing mechanisms to identify and report all events through a local issues management process, conducting awareness campaigns, or improving communication initiatives between contractor and site office.



It is important at this point to have a brief discussion on how to establish targets and performance ranges. For the Sub-ORPS ratio metric, what is a good target? Is it 1, or 5, or 10, and where did this number come from? There are two major considerations when trying to establish a target. First, research whether there are any established, comparative benchmarks. Many metrics have long-standing performance benchmarks. Nearly everyone is familiar with the common grading scales for schools. In general, the target for excellence in school is about 90% (an A-). The performance ranges associated with this target are also well known and accepted; 90% - 100% is the A range, 80% - 90% is the B range, and so forth. Most understand this kind of target and range method, and it equates well with color designations. The A and B ranges are often blue and green, the C range is yellow, and the D and F ranges are red.

In the absence of a benchmark, the second thing to consider is to establish a "self-benchmark". This requires data gathering to determine the current performance of the metric. Then, management needs to decide if that performance is acceptable or needs to be improved, set the appropriate target and performance range, and take appropriate action to influence the number. When self-benchmarking, management might decide to set a target number or simply decide that performance needs to improve a certain percentage over the last performance period. Either method works with self-benchmarking.

All of the sites should consider these two methods for establishing targets and performance ranges, and every site will be different. There is no reason that everyone has to be the same. For the metrics discussed below, the team occasionally provided a suggested starting point. In general, however, the team felt it was better if each site determined where their targets and performance ranges should be set. When these targets and ranges are set, each site needs to keep in mind the ultimate goal of any leading indicator, which is to help ensure sustained good performance or performance improvement for the desired outcome.

For the Sub-ORPS Ratio, there is no solid, well-established comparative benchmark. Sites should therefore gather data for this metric and determine their ratio. For example, site X gathers the data and finds that the ratio is 1 to 1 (or simply 1), which means that for every single ORPS report there is only one precursor event. Site X would use this initial ratio as the basis for setting a target and performance range for the metric for the year. Management might determine that they want this ratio to be 2 to 1 by the end of the year, or perhaps they want a 25% increase in the ratio over last year. Either way, they would set the target based on this expectation and take action to impact the number. The team determined that the performance target for this metric should be at least 1 to 1, with the goal of steady increase.

An important accompanying measure for Sub-ORPS Ratio that the sites should consider is an indicator of **Sub-ORPS Management**. It is one thing to document all of the Sub-ORPS events, or the events that are occurring "below the waterline." It is quite another to measure whether these Sub-ORPS events are being managed via effective analysis and correction. This measure would indicate whether a site was being successful in reducing the overall size of the Event Iceberg, which in turn should result in a reduction in the severity and frequency of events that occur above the waterline. The team suggested that the sites track and manage their Sub-ORPS events via their respective issues and corrective action management programs. This will aid in the development of measures that monitor Sub-ORPS Management.

ORPS Categorization Percentage

Along with the Sub-ORPS ratio, the team felt that this metric helped to demonstrate a culture of timely response to, and management of, operational events. In the past, sites were often held more accountable to rote compliance with the 2-hour time "limit" between discovery and categorization rather than whether the contractor had instilled a culture of effectively managing the response to all adverse events. Simply putting this measure into the "process" metric category and expecting rote compliance often had the unintended consequence of driving sites to "manage" the time and date of discovery data rather than the appropriate response. This unintended consequence has led to countless hours of unnecessary debate regarding the strict definition of "discovery date and time". The team decided a metric was needed that avoided the tendency toward ***data*** management and encouraged a culture of ***actual*** management of effective and timely event response.

Instead of simply measuring the average time between discovery and categorization or the number of occasions a contractor exceeded the time "limit", the metric is the percent of total ORPS events that are categorized within two hours of discovery. The new metric enables a culture of effectively and consistently managing event response rather than finding ways to manipulate data for compliance sake

when it is done wrong. From the Order, "Discovery Date and Time" is the date and time when facility staff discovered, or became aware of, the event, ***not*** the time when management got around to gathering and evaluating all the facts to determine possible reportability. The metric is defined by the following simple equation:

((Total ORPS Events – Number of ORPS Events Categorized > 2 hours from Discovery) / Total ORPS Events) X 100%

Plugging the appropriate data into this equation will produce the desired percentage. Note that if there are no ORPS events categorized greater than 2 hours (meaning all were categorized within 2 hours), the number will be 100%. Also, note that if you have no ORPS events at all, you will get zero over zero, which is a bad answer for number crunchers. However, there are a few ways around this. First, you can set your time interval for data collection to be long enough to avoid having zero for a total number of ORPS events. Second, regardless of your time interval, if you end up with zero over zero, this means you have no ORPS reports! Third, you can include Sub-ORPS categorization determinations in this metric. The metric would then become:

((Total Events – Number of Events Categorized > 2 hours from Discovery) / Total Events) X 100%

In this modified metric equation, the term "Events" is the total of ORPS and Sub-ORPS events in the respective categories. This modified metric would also work well with the above Sub-ORPS ratio.

Regarding targets and performance ranges for this leading indicator, you have a couple of options. One is to use a relatively ***standard convention***, such as a target of 85% with performance ranges of 85% - 100% being "good" or green, 70% to 85% being "caution" or yellow, and < 70% being "alert" or red. You can also self-benchmark by determining the initial state of the metric using at least a year of data, and then establishing an appropriate target and performance ranges that drive sustained performance or improvement. The team suggested that all sites use the self-benchmark approach for this particular metric.

Process: Effective and Timely Communication of ORPS Events

This is the critical success factor related to "Process". The metrics for this critical success factor are the indicators that monitor the execution of the various steps in the ORPS process. The team suggested a number of measures for this critical success factor from which the sites could choose. The sites do not need to use all of the suggested measures, just those measures where the sites have determined that they might have current or emerging process problems. Nearly all of the measures below are expressed as "percentages", which means that a standard convention method works well for selecting targets and performance ranges. However, the team suggested that all sites should consider using the self-benchmarking method to determine targets and performance ranges for all of these metrics, and to use at least one year of data to determine the initial starting point. The following is the list of measures:

1. **Percent of prompt notifications completed within two hours of categorization:**

   ((Total Prompt Notifications – Number of Prompt Notifications > 2 hours from Categorization) / Total Prompt Notifications) X 100%

   Note that Operational Emergencies (OE) have different notification time requirements than those above, so modify accordingly if this metric is needed for OE.. Also, note that this metric can be modified to measure the time of notification to the local site office. The team suggested that the

time-period for this metric be a calendar year. The metric would therefore "reset" each calendar year.

2. Percent of written initial notifications completed within ORPS Model timelines:

((Total Written ORPS Notifications – Number of ORPS Notifications Submitted > Model Timelines) / Total Written ORPS Notifications) X 100%

Note the term in this equation of "Model Timelines". The different significance categories have different time requirements for written notification. If needed, adapt this measure as necessary to monitor written notification performance for the different significance categories. The team suggested that the time-period for this metric be either a rolling six months or rolling year. Using either of these rolling periods would provide a relatively large data set while still being reflective of the most recent process execution efforts.

3. Percent of final ORPS reports (not SC 4) submitted within 45 days:

((Total Final ORPS Reports Submitted – Number of Final ORPS Reports Submitted > 45 Days) / Total Final ORPS Reports Submitted) X 100%

Note that this measure strictly monitors performance associated with submitting final reports (other than SC 4) within the 45-day time-frame. The measure could be modified to include considerations of reports that were submitted after 45 days but had been under an extension. Some prefer this 'overall compliance" option. The metric would then become:

((Total Final ORPS Reports Submitted – Final ORPS Reports Submitted > 45 Days and not under extension) / Total Final ORPS Reports Submitted) X 100%

The team suggested that the time-period for this metric be either a rolling six months or rolling year.

4. Percent of Open Reports Greater than 90 Days Old:

((Total Open Reports (not SC 4) – Number of Open Reports > 90 Days Old) / Total Open Reports (not SC 4) X 100%

Note that this measure monitors the percentage of open reports that have exceeded the ORPS final report timelines by a factor of two or more, regardless of whether they have approved extensions. This metric monitors whether there are a disproportionate amount of "old" reports. Self-benchmarking should be used to determine targets and performance ranges.

5. ORPS Backlog:

Total Number of Open SC 1, 2, 3, R, and OE Reports > 45 Days Old

Note that this measure is ***not*** expressed as a percentage. This is a simple count of open occurrence reports that are over 45 days old. Sites should use the self-benchmarking method to determine targets and performance ranges.

To aid in the development of other measures that monitor the ORPS process, the team suggested that the sites consider developing a basic checklist that covered the critique process. Each site could develop a

checklist tailored to their specific needs that would help them ensure the effective execution of the various elements of a critique, including necessary and sufficient attendance, consideration of necessary immediate actions and scene preservation, and so forth. This critique checklist would also be the ideal mechanism for the sites to capture the initial timeline information that would be useful for metrics. This information would include dates and times of discovery, categorization, site management and DOE notification, date and time of critique, and other pertinent process related information. Gathering the date and time of the critique, for example, would allow developing a measure that tracked the timeliness of the critique process, such as the percentage of critiques held within one business day of categorization.

Note that all of the metrics above are actionable to some degree. Some are dependent on available resources, some are dependent on the effectiveness of internal processes for initial event identification and notification, and some are ultimately dependent on the effectiveness of past corrective actions toward preventing event recurrence. In some cases, the action to influence can be difficult, but they are all actionable.

Quality: High Quality Causal Analysis and Effective Corrective Actions

This is the critical success factor related to "Quality". The metrics for this critical success factor should indicate whether a site is implementing a quality program, not just a compliant program. As many have experienced, by the time many occurrence investigations reach the corrective action phase, a great deal of steam has been lost along the way and often other events have occurred that steal attention and resources from on-going event investigations. This loss of steam and attention comes at arguably the most important phase of the ORPS Process; namely, the development of effective corrective actions that prevent recurrence. Many metrics have been developed that monitor corrective action completion, but few if any on corrective action effectiveness. There is a reason for this; developing metrics based on action completion rates is easy, developing metrics that track corrective action effectiveness is not.

It is important to engage in a brief discussion about causal analysis and corrective actions. Upon reviewing countless causal analyses and corrective actions, a theme emerges; the causal analysis does not seem to be nearly as important as what someone is willing to do about it. Regardless of the causal analysis, corrective actions seem to gravitate toward easy, cheap, local, and quick. A review of the profile of corrective actions taken in response to ORPS events demonstrates this point.

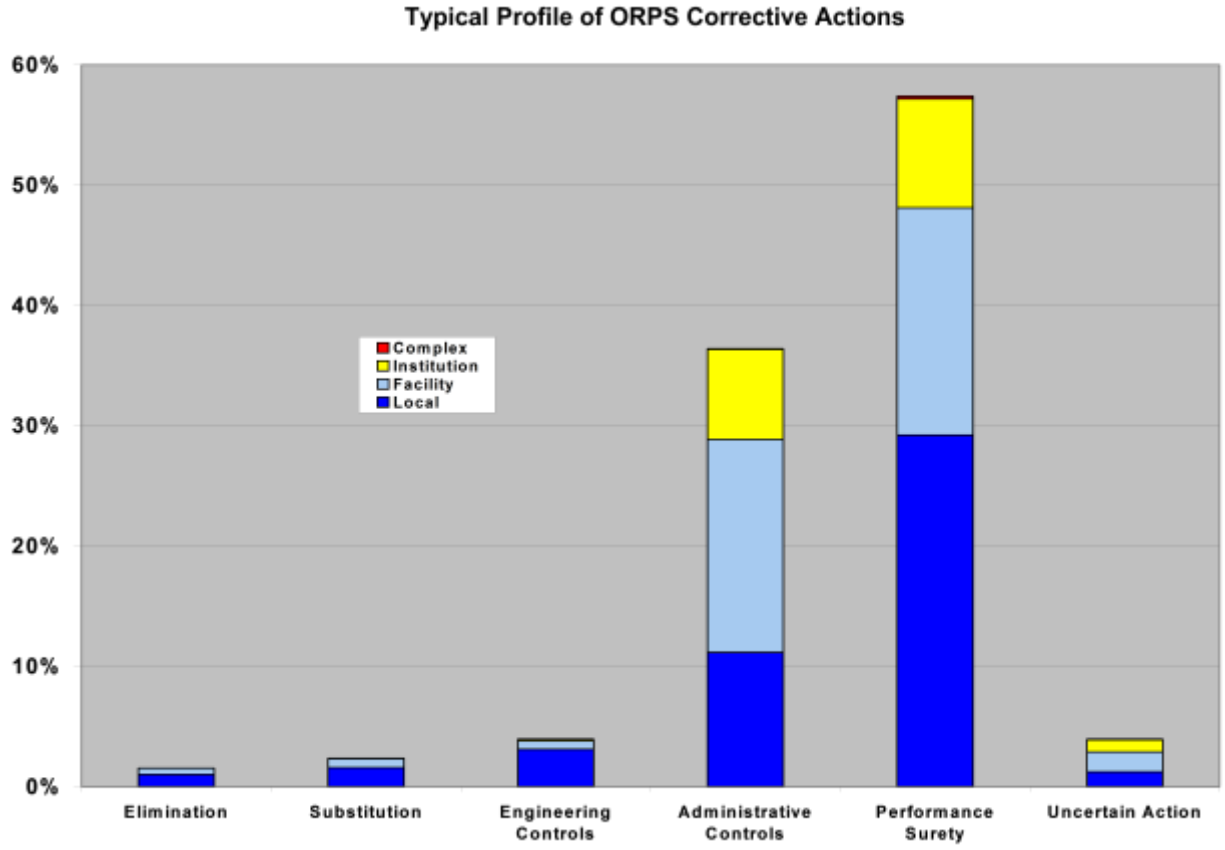
A basic tenant in developing safety and health related work controls is to consider the universally recognized "hierarchy of controls." The following describes this hierarchy as it relates to ORPS corrective actions:

- **Elimination**: a corrective action that lastingly removes the hazard
- **Substitution**: a corrective action that significantly and lastingly reduces the level of hazard, including replacing the hazard with something significantly less hazardous
- **Engineering Control**: a corrective action that involves the installation of an engineered barrier between the hazard and the affected person, place, or thing
- **Administrative Control:** a corrective action that involves modifying or developing a new policy or procedure to minimize the impact of the hazard (this includes workforce management and training or re-training)

- **Performance Surety Control:** an action that enhances or enforces administrative controls and includes area walk-downs, disciplinary actions, document or equipment reviews, safety meetings, briefings, issuing bulletins, alerts, or memos, allocating resources, personnel actions, repairing broken parts, and wearing additional PPE

When actions are developed and implemented, it is also important to consider the scope of that action. Again, for the purposes of this paper and ORPS corrective actions, the scope is considered to be of local, facility-wide, or institutional impact.

Knowing this information, each site could assign a corresponding hierarchy and scope to each ORPS corrective action. This data would provide valuable insight on the types of actions taken to prevent event recurrence. One site used this data and developed the following chart, which shows the percent of total ORPS corrective actions against the hierarchy of controls and associated scope.



The important points from this chart are, 1) only a small percentage of corrective actions targeted elimination, substitution, or an engineering control, 2) a large percentage of actions involved new or modified administrative controls, and 3) the bulk of all corrective actions for ORPS reports involved some form of performance surety action. Note the scope of the actions, with a mix of local, facility, and institutional (and even a couple of complex-wide actions). Note also that some actions did not fit ***any*** category, and therefore fell into the "Uncertain Action" bin. Finally, although the action profile displayed in the chart is from a single contractor, very similar profiles likely exist for all contractors. The team suggests that each site determine the profile for their respective corrective actions.

There is no data showing the ideal action profile; however, there are important "targets" embedded within the profile that can help focus corrective action efforts and metric development. First, although it is true that the causal analysis should drive corrective action, it seems that that the causal analysis and corrective actions are somewhat disconnected by time, cost, and effort considerations. It is important to remember the overall objective of corrective actions, which is to achieve lasting correction with minimal time, energy, and resources, not "fixes" that are easy, cheap, and quick. With this in mind, each site should consider the hierarchy of controls when developing corrective actions. The sites should also make a conscious effort to shift from right to left on the chart during the action development process. The reasons are simple. Actions associated with the left side of the chart, elimination, substitution, and engineering controls, tend to be much more sustainable and effective at preventing event recurrence. Actions on the right side, administrative control and performance surety, tend to have short half-lives and are much less effective without continual re-enforcement of time, energy, and resources. It seems clear then that shifting more often to the left will help meet the overall objective of corrective actions. The team also strongly suggested that all of the sites consider the hierarchy and the need to consider shifting more toward the left side of the chart during work planning activities.

The team kept all of the above in mind as they focused effort on suggestions for metrics that monitored the two important quality aspects, causal analysis and corrective action. The hard part of suggesting metrics in this area is that there are not many processes already set up to gather the necessary data to create meaningful metrics. Each site should therefore consider establishing such processes, such as quality review checklists for both causal analyses and corrective actions. These checklists need to include steps that monitor and document the connections between causal analysis and corrective action. They should also document the quality and scope aspects of corrective actions. Finally, the sites should implement processes for determining both the sustained execution and effectiveness of corrective actions.

Once all of these processes are in place, the sites can develop actionable metrics to monitor performance. The sites would use the self-benchmarking method with a minimum of one year of data for establishing targets and performance ranges for all of the following suggested metrics:

1. **Corrective Action Quality Index:** This metric would require a checklist to document corrective action quality criteria, including hierarchy of control and scope. Developing this metric would involve assigning an index score to each corrective action based on the hierarchy of control and scope. The index score for an action is highest for elimination and lowest for performance surety. The index score also increases as the scope of the action increases. Once the data is in, this metric lends itself well to "smoothing" via a rolling average. The goal is an improving trend, not necessarily an absolute number.

2. **Percent of Corrective Actions Determined to be Effective:** This metric would require a documented effectiveness evaluation process, but the metric itself is simple.

   ((Total Corrective Actions – Number of Actions Determined to be Not Effective) / Total Corrective Actions) X 100%

   This metric is a percentage. Like all other similar percentage metrics, standard conventions work well for setting targets and performance ranges. However, at least initially, the team recommends that each site use the self-benchmarking method to establish targets and performance ranges.

Note that there is always a lag time in determining action effectiveness. The usual rule of thumb is to wait six months to do an effectiveness evaluation. However, sites should base the time to perform an effectiveness evaluation more on the scope of the action and the needed impact rather than always following a rule of thumb.

3. **Percent of ORPS Reports Approved 1st Time by FR:** The underlying premise for this metric is that the Facility Representative provides an independent check of the quality and linkage of the causal analysis and corrective actions. Success is determined by whether this independent check approves the report on the first attempt.

   ((Total SC 1, 2, R, and OE Finals Submitted – Number of Finals Initially Rejected by FR) / Total SC 1, 2, R, and OE Finals Submitted) X 100%

The team discussed a number of other metric possibilities for this critical success factor. These possibilities included the number of repeat events and the number of issues written against causal analysis and corrective action quality. However, the team determined that the sites would be better served by focusing thought and effort on the above three metrics and the overall general corrective action discussion.

Learning: Reduction in Severity and Frequency of Adverse Events

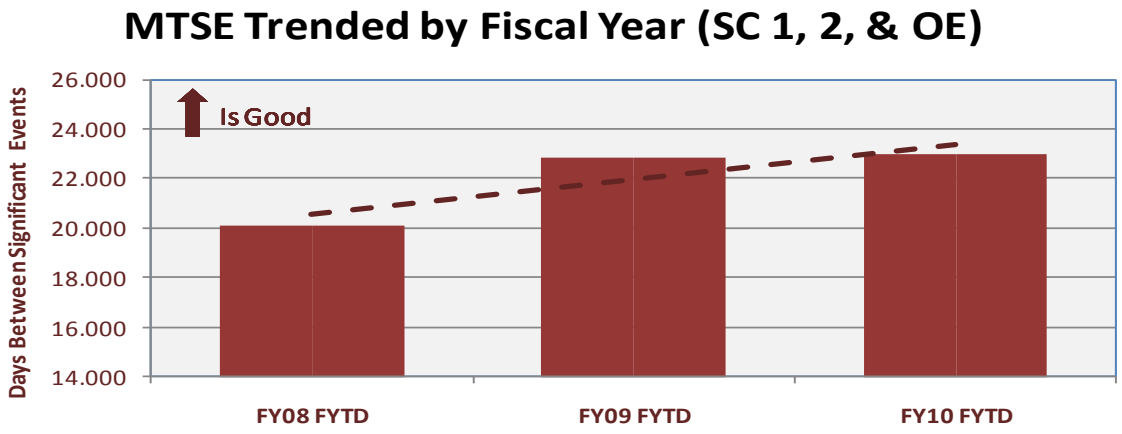
This is the critical success factor related to "Learning". The basic idea behind this last critical success factor is that if a site is effectively implementing all of the elements of an ORPS Program, including culture, process, and quality, the result will be a learning organization that experiences a reduction in the severity and frequency of adverse events. Notice that the team did not simply say a reduction in ORPS events, which would ***not*** be a good leading indicator, as demonstrated by the following illustration.

Most are aware of the anecdote of the company that had a single indicator of safety success, which was the number of days without a lost workday case. The company handed out cash awards to employees when the company did not experience lost workdays. The world thought the company had a great safety record as they watched them hand out the cash awards each year. What many did not know, however, was that when some employees reached out a hand to receive their cash, they carefully hid their other severely injured hand, or "bloody stump", in their pocket. The unintended consequence of the company's unbalanced metric system was that nobody reported any work injuries, but everyone took the cash.

It is *very likely* that if you equate operations improvement or ORPS program effectiveness with a simple reduction in ORPS events, especially if you give constant negative incentives to management and staff when they experience an event, you ***will*** strongly encourage and inevitably achieve "under-reporting". Both contractor and DOE management and staff should carefully consider the potential unintended consequences of their actions with regard to ORPS metrics and potential negative incentives.

Again, the team suggests that the sites do not simply measure the number of ORPS reports. Instead, sites should develop the following metric for tracking the severity and frequency of adverse events:

1. **Mean Time between Significant Events (MTSE):** DOE has already built in significance levels for each ORPS event. Each site should use this significance level for developing the metric. Since the intent is to track the more significant adverse events, the sites should start by tracking the mean time between SC 1, 2, and OE occurrences. The sites could also develop metrics that individually tracked the MTSE for SC3 and SC4 events. MTSE generally works best when it is tracked quarterly but can also be tracked annually to show longer-term trends. The following chart is an example of an MTSE annual trend chart. MTSE trend charts are also informative in ORPS quarterly analysis reports.

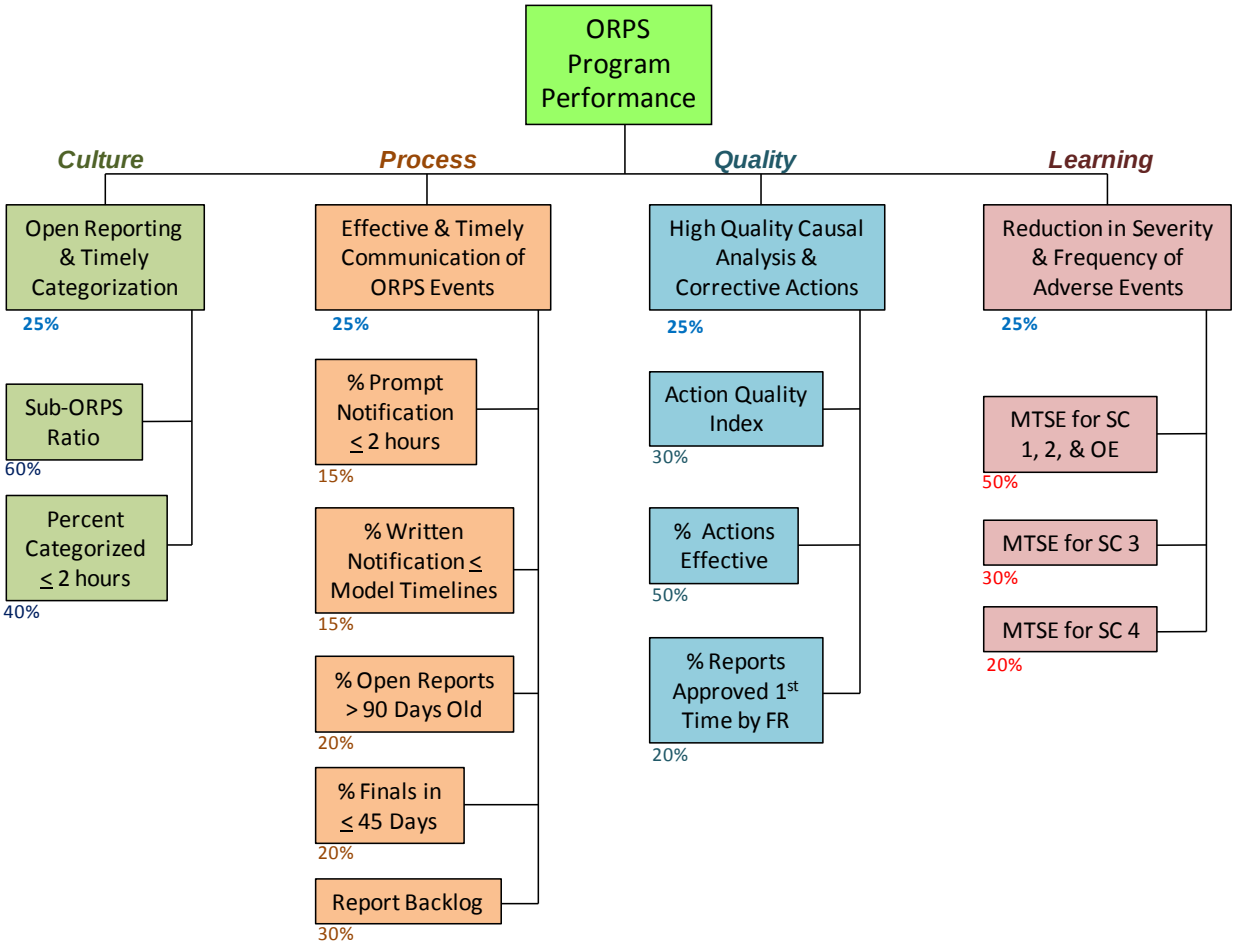


Note that MTSE is not an actionable measure. It is much like the scale in the simple illustration for body weight. MTSE is therefore an outcome measure. The intent of including it in this document is to provide a useful outcome measure that provides context for all of the other leading indicators described in the paper.

The team suggests that the sites use the self-benchmarking method for establishing targets and performance ranges. As was the case for the Corrective Action Quality Index, the goal should be an improving trend or improved performance over the previous review period, rather than an absolute number. The team also recommends using at least two years of data for determining the initial starting point.

Conclusion: The ORPS Program Metric Hierarchy

Over the course of the three-day EFCOG ORPS Task Group meetings, all members of the group actively and productively participated and collaborated to assemble all of the elements of this EFCOG Best Practice Document. The results of this effort are summarized on the following page in the ORPS Program Metric Hierarchy:



Arguably, the most important feature of the ORPS Program Metric Hierarchy is the balance. As this paper has mentioned, in the past, organizations often rather narrowly focused on small pieces of the program, wrote compliance with timelines and numbers of ORPS reports, to name a couple. This narrow focus often caused a loss of perspective on the overall objectives of the program. Through the above hierarchy, and all the associated discussion, the team intended to provide a start in the right direction in trying to capture and measure all of the essential elements of an ORPS Program and stress the importance of the balance of all of the critical success factors, Culture, Process, Quality, and Learning.

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