OSHA® FactSheet

The Use of Metrics in Process Safety Management (PSM) Facilities

Metrics are measures that are used to evaluate and track the performance of a facility's process safety management program. For facilities that handle highly hazardous chemicals, metrics can be used to quantify how a process has performed historically, how it might perform in the future, and where improvements can be made to keep workers safe.

This document provides employers with examples of metrics that are tracked by facilities that are enrolled in OSHA's Voluntary Protection Program (VPP). Because VPP sites have achieved a high standard of safety excellence, tracking these metrics can make a positive contribution to the effectiveness of an employer's process safety management program.

Two types of metrics—lagging metrics and leading metrics—are often used to track safety performance in process safety management:

- **Lagging Metrics:** Lagging metrics are a retrospective set of metrics that are gathered after the occurrence of an incident that has met an established threshold of severity.[1] Lagging metrics evaluate the causes of an incident and whether the factors that led to the incident indicate potential recurring problems. Metrics for relatively minor or "near miss" incidents are often included in the evaluation of process safety performance.
- **Leading Metrics:** Leading metrics are a preventive set of metrics that reveal the performance of key work processes, operating discipline, and layers of protection that prevent incidents.[2] Leading metrics can provide an early indication of problems that can be corrected before a major process safety incident occurs.

Whether using leading or lagging metrics, the metrics should be specific to a facility's operations and culture so that they have the best chance at driving effective results.

VPP
Voluntary Protections Programs
An OSHA Cooperative Program

How Metrics are Tracked by VPP Facilities

A majority of VPP facilities track at least one metric electronically on at least a monthly basis. The metrics are being tracked in a variety of ways. One way is by identifying areas in a PSM program where improvements can be made. For example, during a monthly meeting, the PSM department of one facility identified a problem with tracking the expiration dates for their temporary management of change (MOC) process. The dates were not at the same place, and could not be located. This made it difficult to search databases for the dates. As a solution, the PSM department added a searchable data designation that would enable each MOC change requestor to enter a duration of no longer than 180 days for any temporary MOC. This not only enabled the PSM department to identify expiration dates for temporary MOCs, but made it easier for the change requestor to establish durations or time limits for temporary MOCs.

Another facility tracked the number of overdue items in an effort to reduce the number of tasks that had not been completed in a timely manner.

By holding monthly meetings to review the overdue items, the management team was able to prioritize the completion of those items and identify outstanding projects that were in need of additional resources.

What Metrics are Tracked by VPP Facilities

Based on the responses received from VPP facilities, OSHA compiled a list of areas within the PSM program and the metrics that were used by VPP facilities to track performance in those areas.

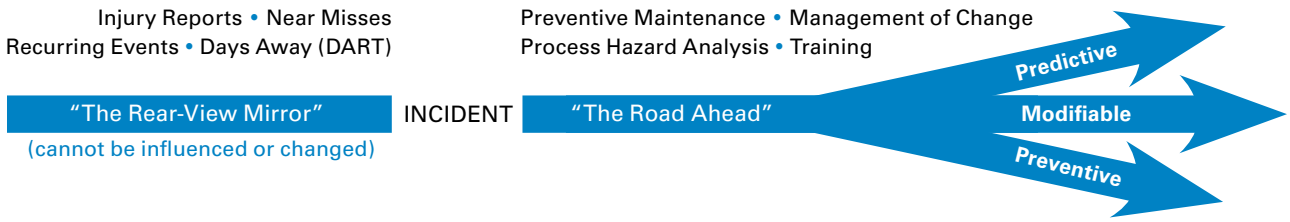
Lagging Metrics

- **Injury and/or Incident Reports Related to Process Safety:** Incident reports are created after an incident investigation has been completed. Incident reports typically describe the causes of an incident that were identified by the investigation, and the corrective measures that should be taken to address those causes.[3] VPP sites have used metrics to track a number of process safety incidents and injuries including:
  - Near miss incidents reported that did or could have led to a loss of containment;
  - Recordable injuries and first-aid incidents due to loss of primary containment;
  - Number of incidents vs. number of incidents with formal reports; and
  - Status of incident investigations.
- **Loss of Containment:** A Loss of Containment is an unplanned or uncontrolled release of materials. For incidents related to loss of containment, VPP facilities have tracked:
  - The number of incidents;
  - Whether there was primary or secondary containment; and
  - The cause and location of the incident.

Leading Metrics

- **Management of Change (MOC):** An MOC is a system that identifies, reviews, and approves all modifications to equipment, procedures, raw materials, and processing conditions, other than "replacements in kind," prior to implementation.[4] There are various types of changes that occur in the workplace where a facility may want to track management of change to reduce the likelihood of system failures or catastrophic events. For MOC, VPP facilities have tracked:
  - Overdue MOCs;
  - Approved MOCs;
  - Open MOCs; and
  - MOCs performed each month.
- **Preventive Maintenance (PM):** Preventive maintenance is maintenance that is regularly performed on a piece of equipment to decrease the likelihood of it failing. In their maintenance efforts, VPP facilities have tracked:
  - Completion rates;
  - Open items;
  - Overdue safety critical PMs; and
  - Number of inspections.
- **Process Hazard Analysis (PHA):** A process hazard analysis is a systematic effort to identify and analyze the significance of potential hazards associated with the processing and handling of highly hazardous chemicals.[5] A PHA analyzes potential causes and consequences of fires, explosions, releases of toxic or flammable chemicals, and major spills of hazardous chemicals. It monitors equipment, instrumentation, utilities, human actions, and external factors that might affect the process.[6]

  VPP facilities have monitored the PHA process by tracking:
  - PHA actions open;
  - PHAs overdue;
  - PHAs completed;
  - Scheduled vs. completed PHAs;
  - Status of PHA/incident recommendations; and
  - Status of scheduled PHA revalidations.



- **Mechanical Integrity (MI):** Mechanical integrity is a program that ensures that equipment is properly designed, installed in accordance with specifications, and remains fit for its purpose.[7] As part of the MI program, facilities will collect data on planned inspection work for safety critical equipment and any data that can provide solutions to correct weak performance. VPP facilities have been tracking the following leading metrics as part of their MI program:
  - Number of inspections scheduled (relief valve, piping, pressure vessel, storage tank);
  - Status of variance requests;
  - Routine inspections; and
  - Number of overdue work orders.
- **Training:** Training is the practical instruction of job task requirements and methods. VPP facilities have tracked:
  - Safety/refresher training completed;
  - Training planned vs. completed;
  - Training exceptions; and
  - Contractor training.
- **Safety Action Item:** A safety action item is a document, event, task, activity, or action that needs to take place, such as a follow-up on PHA, Incident Investigation, MOC, or Compliance Audit recommendations. It may also include planned inspections, tests, maintenance activities, training, or other safety-related activities. VPP facilities have tracked:
  - Past action items;
  - Initiated vs. completed items; and
  - Open action items.

Contractor Metrics

Some contractors also track their own metrics while working on a VPP host site. Some of these metrics include:

- Types of near miss incidents reported;
- Types of first-aid cases;
- Incidents involving property damage at host site;
- Job hazard analysis completed; and
- Number of audits and corrections.

Conclusion

Metrics can play a valuable role in revealing the strengths and weaknesses of a facility's performance. However, the habit of tracking metrics will not alone improve process safety. Metrics should be used along with a variety of other methods to work towards achieving and maintaining outstanding process safety performance.

For more information on process safety management, see: www.osha.gov/SLTC/processsafetymanagement.

For additional guidance on developing process safety metrics, please refer to:

- ANSI/API RP 754, *Process Safety Performance Indicators for the Refining and Petrochemical Industries*, Second Edition.
- Center for Chemical Process Safety (CCPS), *Guidelines for Process Safety Metrics*
- CCPS "Process Safety Leading Indicators Industry Survey" http://www.aiche.org/sites/default/files/docs/pages/leading-indicator-survey_0.pdf

---

[1] *Guidelines for Process Safety Metrics*, Center for Chemical Process Safety, 2010, p. 20.
[2] Id. at p.23.
[3] *Process Safety Management Guidelines for Compliance*, DOL, OSHA, 1994. www.osha.gov/Publications/osha3133.html
[4] *Guidelines for Process Safety Metrics*, Center for Chemical Process Safety, 2010, p. xvi.
[5] *Process Safety Management Guidelines for Compliance*, DOL, OSHA, 1994. www.osha.gov/Publications/osha3133.html
[6] Id.
[7] *Guidelines for Process Safety Metrics*, Center for Chemical Process Safety, 2010, p. xvi.

This is one in a series of informational fact sheets highlighting OSHA programs, policies, or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

For assistance, contact us. We can help. It's confidential.

OSHA® Occupational Safety and Health Administration

www.osha.gov (800) 321-OSHA (6742)

U.S. Department of Labor

DOC FS-3896 10/2016