Key performance indicators (KPIs) focus on the use of leading and lagging indicators that are selected and monitored to target for improvement. Leading indicators are process-focussed metrics that signify the function of operating discipline, processes, or safety barriers/controls. Leading indicators are selected to provide an early signal of potential issues or degradation of safety controls so proactive corrective actions can be conducted. Lagging indicators are outcome-focused metrics that can signify recurring issues and include events that have taken place.

Self-Assessment & Action Plan

Visit Key Performance Indicators on pellet.org for:

* Self-Assessment & Action Plan Worksheets
* Improvement Tools & Resources
* Leading and Lagging Indicators Guidelines

When completing the Self-Assessment & Action Plan below:

* If you identify a gap in any of the questions, develop an action plan.
* When choosing due dates for the action plans, consider the following to determine priority:
	+ The anticipated effort required to close the gap and make improvements,
	+ The benefits expected from taking action and implementing change, and
	+ The urgency (e.g., perceived risk) of the improvements needing to be made.

Key Resources

* [PSM Implementation: How to Use the Self-Assessment Worksheets](https://pellet.org/resources/how-to-use-the-psm-self-assessment-worksheets/)
* [Process Safety Management](https://pellet.org/safety/safety-initiatives/process-safety-management-psm/) on [pellet.org](http://pellet.org/)
* [CSA Z767 Process safety management standard (2nd edition)](https://www.csagroup.org/store/product/CSA_Z767%3A24/)

Materials are being updated all the time - come back to pellet.org often.

Suggested Activities

* Develop leading indicators that measure the performance of work processes, procedures, and equipment that prevent incidents.
* Develop lagging indicators based on process safety incidents that measure weaknesses, defects or failures in processes, procedures, and equipment.
* Communicate process safety metrics to all personnel.

Suggested Deliverables

* Established a process to review and communicate key performance indicators, including target and actual, to management and employees on a routine basis.

References

* Rayner Brown, K., Murray, G., Laturnus, B., Yazdanpanah, F., Cloney, C., Amyotte, P.R. (2024). [*Integrating Process Safety Management into Canadian Wood Pellet Facilities that Generate Combustible Wood Dust.*](https://onlinelibrary.wiley.com/doi/10.1002/cjce.25462) The Canadian Journal of Chemical Engineering. 102, 4085-4103.
* WorkSafeBC. (2022). [*Managing Risks in Manufacturing Workplaces: How to Use the Self-Evaluation Tool*.](https://www.worksafebc.com/en/resources/health-safety/information-sheets/managing-risks-manufacturing-how-to-use-self-evaluation) Last accessed April 2024.
* WorkSafeBC. (2023). [*Enhancing Health & Safety Culture & Performance: Self-Evaluation Tool for Managing Risks in Manufacturing Workplaces*](https://www.worksafebc.com/resources/health-safety/checklist/managing-risks-manufacturing-assessing-mobile-equipment?lang=en&direct). Last accessed April 2024.

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|  |
| --- |
| 1. **Have you identified leading and lagging key performance indicators (KPIs) for process safety at your facility?**

 [ ]  Yes (formalized and documented) [ ]  No [ ]  Unsure  |
| **Action owner** | **Due date (yyyy-mm-dd):** |
| **Plans and actions needed to address gap or improve existing approach**      |
| 1. **Are unsafe behaviours or inadequate operational discipline measured? Operational discipline is defined as the performance of all tasks correctly every time.**

 [ ]  Yes (formalized and documented) [ ]  No [ ]  Unsure  |
| **Action owner** | **Due date (yyyy-mm-dd):** |
| **Plans and actions needed to address gap or improve existing approach**      |
| 1. **Are process safety near misses tracked? These may include, for example, small fires, system failures or instrumentation failure that could lead to an incident.**

 [ ]  Yes (formalized and documented) [ ]  No [ ]  Somewhat [ ]  Unsure  |
| **Action owner** | **Due date (yyyy-mm-dd):** |
| **Plans and actions needed to address gap or improve existing approach**      |
| 1. **Are near misses collected and used for lessons learned, enhancing awareness, and improving process safety culture?**

 [ ]  Yes (formalized and documented) [ ]  No [ ]  Somewhat [ ]  Unsure  |
| **Action owner** | **Due date (yyyy-mm-dd):** |
| **Plans and actions needed to address gap or improve existing approach**      |
| 1. **When selecting key performance indicators, which of the following are considered? Check all that apply.**

[ ]  Not applicable—process safety key performance indicators have not been selected.[ ]  Indicators refer to process safety critical equipment and items that influence system performance.[ ]  Indicators advance process safety performance improvement and learning.[ ]  Indicators are relatively easy to implement, measure, and understood by stakeholders.[ ]  Indicators can be used for benchmarking.[ ]  Not applicable. |
| **Action owner** | **Due date (yyyy-mm-dd):** |
| **Plans and actions needed to address gap or improve existing approach**      |
| 1. **Which of the following lagging indicators are tracked? Check all that apply.**

[ ]  Not applicable—process safety key performance indicators have not been selected.[ ]  ID (induced draft) fan fire.[ ]  Silo fire.[ ]  Pelletizer/extruder fire.[ ]  Cooler fire.[ ]  Pipe fire.[ ]  Dryer fibre silo fire.[ ]  Conveyance fire.[ ]  Fibre pile fire.[ ]  Mobile equipment fire or deflagration.[ ]  Hammer mill deflagration.[ ]  Belt-dryer deflagration.[ ]  Deflagration propagation (multiple equipment impacted).[ ]  Others (list):  |
| **Action owner** | **Due date (yyyy-mm-dd):** |
| **Plans and actions needed to address gap or improve existing approach**      |
| 1. **Which of the following leading indicators related to electrical upset conditions are tracked? Check all that apply.**

[ ]  Not applicable - process safety key performance indicators have not been selected.[ ]  Loss of power. [ ]  Communication error or loss of communication between HMI/PLC (human-machine interface/programmable logic controller).[ ]  ID fan failure (loss of air flow) due to electrical loss/power outage.[ ]  Deluge system failure due to electrical loss/power outage.[ ]  Electric fire pump due to electrical loss/power outage.[ ]  Fire or explosion detection systems malfunction due to electrical loss/power outage.[ ]  Auto deluge malfunctions.[ ]  Motor failure.[ ]  Others (list):       |
| **Action owner** | **Due date (yyyy-mm-dd):** |
| **Plans and actions needed to address gap or improve existing approach**      |
| 1. **Which of the following leading indicators related to mechanical upset conditions are tracked? Check all that apply.**

[ ]  Not applicable—process safety key performance indicators have not been selected.[ ]  Cyclone plug-ups/clogs.[ ]  Conveyor plug-ups and breakdowns.[ ]  Dryer infeed conveyor failure.[ ]  Dryer outfeed conveyor failure.[ ]  Drag chain breakage.[ ]  Hammer mill shutdowns.[ ]  Belt breakage (dryer or conveyor).[ ]  Dryer high temperature shutdowns (due to losing power or due to losing feed).[ ]  Motor failure.[ ]  Others (list):       |
| **Action owner** | **Due date (yyyy-mm-dd):** |
| **Plans and actions needed to address gap or improve existing approach**      |
| 1. **Which of the following leading indicators related to environmental/weather upset conditions are tracked? Check all that apply.**

[ ]  Not applicable—process safety key performance indicators have not been selected.[ ]  Deluge system failure due to freezing.[ ]  Dryers having trouble with fluctuating fibre moistures (inconsistent speeds).[ ]  Sparks caused by combustion air fluctuating with ambient air.[ ]  Freeze up in abort gates.[ ]  Freeze up in utilities/compressed air system.[ ]  Operational issues with pneumatic sensing/differential pressure lines/flow sensor due to cold temperatures.[ ]  Freezing of incline conveyors.[ ]  Blower intake screens plugging due to hoar frost.[ ]  Building dry valve systems breaking the drain systems due to frost.[ ]  Excursions of high-speed bearing temperatures, including hammermills and fans during hot ambient temperatures.[ ]  Excursions of high pellet temperatures out of the coolers and into the rail cars during hot ambient temperatures.[ ]  Issues with electrical drives, PDCs (power distribution centres), MCCs (motor control centres) during hot ambient temperatures.[ ]  Others (list):       |
| **Action owner** | **Due date (yyyy-mm-dd):** |
| **Plans and actions needed to address gap or improve existing approach**      |
| 1. **Which of the following leading indicators related to operational upset conditions are tracked? Check all that apply.**

[ ]  Magnets filled with metal contaminants (not cleaned).[ ]  Rock traps full (not cleaned or emptied).[ ]  Worn hammers.[ ]  Holes in hammermill screens.[ ]  Pelleter roll and dies worn or out of adjustment.[ ]  Bridging of material in surge bins.[ ]  Failing bin level indicators or bindicators.[ ]  Fibre too wet or too dry coming into pelleters.[ ]  Decks bridging off or running empty.[ ]  Mixing bin bridging.[ ]  Cooler bins plugging up.[ ]  Manual deluge malfunction.[ ]  Burner will not relight.[ ]  Others (list):       |
| **Action owner** | **Due date (yyyy-mm-dd):** |
| **Plans and actions needed to address gap or improve existing approach**      |

Review of Action Plan for Key Performance Indicators

Complete the following table after corrective actions have been implemented.

|  |
| --- |
| Improvement actions taken      |
| How did you ensure the controls were implemented in a timely fashion? How did you prioritize your actions?      |
| How will you ensure the implemented controls will continue to be effective over time?      |
| How are workers involved in developing and implementing controls?      |
| How do you know that workplace decisions related to safety are effective and sustainable?      |
| How do you measure change to establish a new performance expectation?      |
| When changes are made, how are interrelated procedures, programs, and policies updated effectively?      |
| Is a strategy for continuous improvement in place? How does this process work?      |
| If you have multiple locations, are lessons learned and continuous improvements shared with other locations? How does this process work?       |
| Is the safety management system self-sufficient, or does it rely on specific individuals to make it function? How do you ensure the system remains self-sufficient?      |
| Overall effectiveness of improvement actions.      |