PLANT EFFICIENCY SERIES

DRIVING SUSTAINABILITY WITH KEY PERFORMANCE INDICATORS (KPIs) IN THE ASPHALT INDUSTRY

INTRODUCTION

In today's business world, two concepts stand out, particularly in manufacturing sectors – Sustainability and Key Performance Indicators (KPIs). Given the current environmental concerns and the goals set by the asphalt industry's The Road Forward initiative, led by the National Asphalt Pavement Association (NAPA), it's imperative for asphalt plants to not only be environmentally efficient but also keep their operations in line with predetermined standards. The use of KPIs is increasingly hailed as an effective way to measure and manage environmental performance.

UNDERSTANDING KPIS AND RELEVANCE IN THE ASPHALT INDUSTRY

KPIs are quantifiable measures used to gauge the effectiveness of an organization achieving key business objectives. They serve as navigational tools, providing an objective assessment of the progress an organization is making toward its desired goals. For an asphalt plant, these goals often include production efficiency and strict adherence to environmental regulations.

CRUCIAL ENVIRONMENTAL EFFICIENCY AND CONTROL KPIS FOR THE ASPHALT INDUSTRY

The environmental efficiency and control KPIs for an asphalt plant include a handful of vital metrics that balance operational demands with eco-conscious practices. The primary goal is to reduce the environmental impact of asphalt production. Some of these critical KPIs are:

ENERGY CONSUMPTION PER TON OF PRODUCTION

Energy-efficient production processes significantly decrease a plant's carbon footprint. Monitoring the energy utilized per ton of asphalt production reflects the efficiency of the process, while also offering insight on reducing greenhouse gas emissions and operational costs.

Example: Measure the energy used (kWh for electricity, gallons or liters for fuel) per ton of asphalt produced. Monitor the energy consumption over time and set improvement targets, such as reducing energy usage by X% per year.

NAPA
NATIONAL ASPHALT PAVEMENT ASSOCIATION

GREENHOUSE GAS EMISSIONS

Greenhouse gasses primarily CO_2, CH_4, and N_2O – contribute to global warming. Monitoring these emissions helps maintain regulatory compliance, identifying areas for improvement, and decrease the carbon footprint.

Example: Calculate the total GHG emissions in metric tons of CO_2 equivalent (CO_2e) per year, considering direct emissions (from fuel combustion) and indirect emissions (from electricity usage). Set targets for reducing GHG emissions by X% over a specified period.

PARTICULATE MATTER EMISSIONS

Particulate matters from processes like material handling, drying, and mixing can impact ambient air quality. Regular measurement of these emissions is vital for ensuring adherence to air quality standards.

Example: Measure the PM emissions in milligrams per cubic meter (mg/m^3) or micrograms per cubic meter ($\mu g/m^3$) and ensure they are below the regulatory limits. Set targets to reduce PM emissions by X% over a specified period.

RECLAIMED ASPHALT USAGE

The utilization of reclaimed asphalt pavement (RAP) and reclaimed asphalt shingles (RAS) in production could significantly reduce the need for virgin materials, thus conserving resources, lowering emissions, and promoting sustainability.

Example: Calculate the percentage of RAP and RAS used in asphalt production by dividing the total tonnage of RAP and RAS used by the total tonnage of asphalt produced. Set targets for increasing RAP and RAS usage by X% over a specified period.

WASTE REDUCTION AND RECYCLING RATES

Recycling measures and waste reduction strategies are crucial in an industry where resources are finite. Tracking the effectiveness of these programs can pave the way for sustainable operations.

Example: Measure the total waste generated at the plant (in tons) and the percentage of waste recycled or reused. Set targets for reducing waste generation and increasing recycling rates by X% over a specified period.

NOISE, VIBRATION, AND HABITAT PROTECTION

Monitoring the impact on local ecosystems, like noise, vibration levels, and habitat protection, contribute to a harmonious existence with the environment.

Examples: Noise and vibration control: Measure noise levels in decibels (dB) and vibration levels in terms of peak particle velocity (PPV) or root mean square (RMS) at specific monitoring locations around the plant. Ensure compliance with local regulations and set targets for reducing noise and vibration levels by X% over a specified period.

Biodiversity and habitat protection: Develop quantifiable metrics based on the specific local ecosystems and habitats affected by the plant. Examples include the number of native plant species preserved, the area of protected habitat (in acres or hectares), and the number of wildlife species protected. Set targets for improving biodiversity and habitat protection over a specified period.

CONCLUSION

The successful management and development of KPIs in asphalt plants not only ensures environmental and operational efficiency, but also provides the foundation for a sustainable future. By focusing on these KPIs, institutions can facilitate the evolution of the asphalt plant industry, fostering eco-friendly practices and a sustainable future. Tracking, developing, and managing these KPIs should be an integral aspect of every asphalt plant's management strategy. The attached example worksheet for tracking plant statistics is a valuable tool provided to assist plants in monitoring their sustainability goals. This tool is a practical step towards operationalizing KPIs and should help producers on the journey towards a more sustainable asphalt industry.

The Road Forward

EXAMPLE PLANT EFFICIENCY STATISTICS WORKSHEET

Company ______________________________

Plant ______________________________

Total Tons Produced: ______________________________

Stop Fuel Units: ______________________________

Start Fuel Units: ______________________________

Fuel Units Used: ______________________________

Fuel Units per Ton: ______________________________

BTU's per Unit: ______________________________

Ave Moisture:

____% H_2O Virgin Aggregate Materials x (____% VAM in Mix / 100) = ____

+____% H_2O RAP x (____% RAP in Mix / 100) = ____

Average Moisture = ____

Ave Mix Temp ______________________________

Theoretical BTU's Req'd ______________________________
(See Table from QIP-132 vs. Ave Moisture + Average Temp)

Drying Efficiency Ratio ______________________________
(Theoretical BTU's / Actual BTU's) x 100

Average Exit Gas Temp: ______________________________
(Every 10°F excess gas temp = 1% fuel penalty)

Number of Starts / Stops: ______________________________
(Many starts / stops can raise fuel use 20-35%)

Combustion Zone Shell Temp: ______________________________
(Excessive temps can result in 5-10% fuel loss)

Heating Zone Shell Temp: ______________________________
(Excessive temps can result in 5-10% fuel loss)

Production Rate Capability: ______________________________
(Running at 50-60% of rated tph can result in a 10-15% fuel consumption penalty)

Average Production Rate: ______________________________

Plant Waste (total tons): ______________________________
(Startup Waste + Mistake Waste = Plant Waste)

Plant Waste Ratio: ______________________________
(Plant Waste Tons / Total Tons) x 100

Day / Date ______________________________

Foreman ______________________________

Production Hours: ______________________________

Hours "On Hold": ______________________________

"Breakdown Hours Loss" ______________________________
(Production hours missed for breakdown)

"Maintenance & Repair Hours" ______________________________
(Total maintenance and repair hours for shift)

Total Plant Hours ______________________________
(Prod Hrs + Hold Hrs + Maint Repair Hrs)

On Line Availability Ratio: ______________________________
(Prod Hrs – Breakdown Hrs) / Prod Hrs x 100

Hold Hours Ratio: ______________________________
(Hrs on Hold / Prod Hrs) x 100

Maintenance Hours Ratio: ______________________________
(Maint & Repair Hrs / Total Plant Hrs) x 100

		270°F	300°F	320°F
Percent Moisture	3%	203,600	217,300	226,000
	4%	230,100	244,400	254,200
	5%	255,700	271,600	282,500
	6%	281,200	298,800	310,800
	7%	306,700	325,900	338,900
	8%	332,100	353,000	367,100

To learn more:
https://www.asphaltpavement.org/uploads/documents/Climate/QIP-132_NAPA_Production_Strategies_for_Saving_Money_and_Reducing_Emissions_08-2023.pdf