**Date last modified/updated:** Click here to enter a date. **Internal audit:** Click here to enter a date.

**Who last modified/updated:** Click here to enter text. **Management review:** Click here to enter a date.

**This part of the Navigator Playbook is completed when you have:**

1. **Determined what data or information is needed to establish trends in EnMS performance, including trends in nonconformities, corrective actions, and results in monitoring and measurement, internal and external audits, and evaluations of compliance with applicable energy-related legal and other requirements.**
2. **Determined what data or information is needed to monitor, measure, analyze and evaluate the results of the EnMS and its effectiveness as related to the intended outcomes of your EnMS and the strategic goals and priorities of your organization.**
3. **Determined the methods to be used, when the monitoring and measurement will be done, and when the results will be analyzed and evaluated.**
4. **Implemented the monitoring, measurement analysis of EnMS performance and the evaluation of EnMS effectiveness.**
5. Determine what data or information is needed to establish trends in EnMS performance, including trends in nonconformities, corrective actions, and results in monitoring and measurement, internal and external audits, and evaluations of compliance with applicable energy-related legal and other requirements.

|  |  |  |
| --- | --- | --- |
|  | We have established a process for determining the results of the management system and for connecting these results back to top management’s expectations and the organization’s strategic direction and priorities. | Top management are debriefed monthly after Energy Team meetings wherein information regarding energy performance improvements, greenhouse gas emissions reductions, nonconformities, etc. are related and discussed. |
|  | These expectations and priorities include: |  |

Cost savings

Reduction of CO2 emissions

Reduced risks to security of energy supply

Improved community relations

Other Nonconformities

Other

|  |  |  |
| --- | --- | --- |
|  | We have evaluated the effectiveness of the EnMS using the performance evaluation and improvement processes of the EnMS as outlined below: |  |

Monitoring, measurement and analysis (this task).

Evaluating compliance with the applicable energy-related legal and other requirements (People and Legal Requirements Affecting the EnMS task).

Performing internal audits to provide information on whether the EnMS is effectively implemented and maintained (Internal Audits task).

Management review of the EnMS’s ongoing suitability, adequacy, effectiveness and alignment with the strategic direction of the organization (Management Review task).

Finding and fixing nonconformities and problems in the management system (Corrective Actions task).

|  |  |  |
| --- | --- | --- |
|  | We have developed trend information on EnMS performance and prepared it for review by top management and evaluation of EnMS effectiveness. This trend information includes: | Top management are kept up to date of all trending information related to EnMS performance and maintenance at the monthly Energy Team debrief. |

Nonconformities

Corrective actions

Monitoring and measuring results

Results of EnMS internal audits

Results of EnMS external audits (if applicable)

Results of evaluations of compliance with applicable energy-related legal and other requirements

*The following worksheet can be useful in identifying the compliance evaluation trend information, along with other data and metrics related to trends in EnMS performance that will be monitored, measured and analyzed for management review and the evaluation of the EnMS effectiveness.*

Monitoring and Measurement of Key Characteristics Planning Worksheet

**Date:** 11/1/20 **Prepared by:** Jack Doe

**Key Characteristic: Energy sources, Current energy use and consumption**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Energy Source/**  **Energy Use/**  **Energy Consumption** | **Department** | **How will it be monitored/ measured?** | **How often will it be monitored/ measured?** | **How will the data be analyzed?** | **What calibration is required?** |
| Electricity | All | Utility Bills and Submeters | Bills – Monthly  Submeters - Weekly | Input into energy tracker and utilized in EnPI calculations. | Submeters summed for the month and compared to utility bills. |
| Natural Gas | All | Utility Bills and Submeters | Bills – Monthly  Submeters - Weekly | Input into energy tracker and utilized in EnPI calculations. | Submeters summed for the month and compared to utility bills. |
| Biodigester Gas | Anaerobic Digestion | Submeter | Submeter - Weekly | Input into energy tracker and utilized in EnPI calculations. | Submeters are serviced annually. |

**Key Characteristic: Significant energy uses**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Significant Energy Use** | **Department** | **How will it be monitored/ measured?** | **How often will it be monitored/ measured?** | **How will the data be analyzed?** | **What calibration is required?** |
| Aeration | Aeration | Electricity submeters and controls | Weekly | Utilized in EnPI calculations and compared to average energy usage. | None |
| Anaerobic Digestion | Anaerobic Digestion | Biodigester Gas submeter | Weekly | Utilized in EnPI calculations and compared to average energy usage. | None |
| Disinfection | Tertiary Treatment | Chlorine chemical checks | Daily | Utilized in EnPI calculations. | None |

**Key Characteristic: Variables affecting significant energy uses**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Significant Energy Use Variable** | **Department** | **How will it be monitored/ measured?** | **How often will it be monitored/ measured?** | **How will the data be analyzed?** | **What calibration is required?** |
| Flow | Facilities | Influent Sensors | Continuously | Daily averages and monthly averages are used in EnPI calculations | Annual meter calibration |
| HDD / CDD | Facilities | Collected from internet source | Weekly download | No analysis just used as part of EnPI calculations | N / A |
| BOD | Chemical Lab | Daily testing from chem lab | Daily | Used for quality records and as part of EnPI calculations | Equipment is calibrated quarterly |
| MLSS | Quality Lab | Daily Shift Samples | Every Shift | Lab Process | Annual Calibration |

**Key Characteristic: Future energy use and consumption of the significant energy uses**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Future Energy Use/Consumption** | **Department** | **How will it be monitored/ measured?** | **How often will it be monitored/ measured?** | **How will the data be analyzed?** | **What calibration is required?** |
| Click here to enter text. | Click here to enter text. | Click here to enter text. | Click here to enter text. | Click here to enter text. | Click here to enter text. |
| Click here to enter text. | Click here to enter text. | Click here to enter text. | Click here to enter text. | Click here to enter text. | Click here to enter text. |
| Click here to enter text. | Click here to enter text. | Click here to enter text. | Click here to enter text. | Click here to enter text. | Click here to enter text. |

**Key Characteristic: Energy Performance Indicators (EnPIs)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **EnPI** | **Department** | **How will it be monitored/ measured?** | **How often will it be monitored/ measured?** | **How will the data be analyzed?** | **What calibration is required?** |
| MMBtu/MG | Facilities | Utility bill summation and flow summation | Monthly | Used for performance tracking | N / A |
| MMBtu/BOD | Facilities | Utility bill summation and average BOD | Monthly | Used for performance tracking | N / A |

**Key Characteristic: Action plan completion and effectiveness in achieving objectives and targets**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Action Plan/**  **Objectives and Targets** | **Department** | **How will it be monitored/ measured?** | **How often will it be monitored/ measured?** | **How will the data be analyzed?** | **What calibration is required?** |
| Reduce Energy Intensity of Aeration Process by 15% by 2025 | Aeration | Facilities will consistently monitor energy usage of Aeration via submeters and BAS data | Continuously | Collected energy consumption data will be analyzed and discussed at monthly Energy Team meetings | N /A |

**Key Characteristic: Prioritized energy performance improvement opportunities**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Energy Improvement Opportunity** | **Department** | **How will it be monitored/ measured?** | **How often will it be monitored/ measured?** | **How will the data be analyzed?** | **What calibration is required?** |
| Replace Current Coarse-Bubble Diffusers with Fine-Bubble Diffusers | Aeration | Aeration Submeters and BAS data | Weekly | Energy consumption will be tracked in Energy Footprint Tool and discussed at Energy Team Meetings. | None |
| Upgrade Lighting to LED’s | Facilities | Facility Electricity Submeters and Utility Bills | Monthly | Energy consumption will be tracked in Energy Footprint Tool and discussed at Energy Team Meetings. | None |
| Upgrade to Dissolved Oxygen Controls | Aeration | Aeration Submeters and BAS data | Weekly | Energy consumption will be tracked in Energy Footprint Tool and discussed at Energy Team Meetings. | None |

**Key Characteristic: Actual vs. expected energy consumption**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Actual vs. Expected Energy Consumption** | **Department** | **How will it be monitored/ measured?** | **How often will it be monitored/ measured?** | **How will the data be analyzed?** | **What calibration is required?** |
| Electricity Consumption | Facilities | Utility Bills | Monthly | It will be input into EnPI Lite Tool | None |
| Natural Gas Consumption | Facilities | Utility Bills | Monthly | It will be input into EnPI Lite Tool | None |

1. Determine what data or information is needed to monitor, measure, analyze and evaluate the results of the EnMS and its effectiveness as related to the intended outcomes of your EnMS and the strategic goals and priorities of your organization.

|  |  |  |
| --- | --- | --- |
|  | We reviewed the outcomes, strategic goals and issues that were developed in the task addressing An EnMS and Your Organization. | Yes, all was addressed and documented in Task 01 of the 50001 Navigator |
|  | We developed metrics for the EnMS that align with and support these outcomes, goals and priorities. | We use our EnPIs to quantify our objectives, outcomes, and goals. We design objective criteria ranking tables to outline objective prioritization processes. |
|  | We have obtained input from top management as appropriate. | Top Management has approved the elements of the EnMS in management briefings and review meetings. |

1. Determine the methods to be used, when the monitoring and measurement will be done, and when the results will be analyzed and evaluated.

We have determined the monitoring and measurement methods to be used and when to evaluate results.

*The following worksheet can be helpful in determining and capturing when monitoring and measurement will be done and when results will be analyzed and evaluated. These results will help support your consideration of the timing of internal audits, compliance evaluations, strategic planning and management reviews.*

Energy Measurement Plan Worksheet

Using the output from the Monitoring and Measurement of Key Characteristics Planning Worksheet, complete the following worksheet to develop your Energy Measurement Plan.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **System/ Process/ Equipment and Location** | **What data is collected?** | **How will it be monitored/ measured?** | **How often will it be monitored/ measured?** | **Who is responsible for monitoring and measurement?** | **What calibration is required?** | **What operational control/ maintenance/ design procurement action or action plan is it linked to?** | **Where is data recorded?** | **How is data analyzed?** | **What significant deviation requires action?** | **How does this demonstrate performance?** |
| Aeration | Electrical Energy Usage | Electrical Submeters and Utility Bills | Weekly | Aeration Dept | Utility Rep Calibrates | Reducing Energy Intensity of Aeration Process by 15% by 2025 | Shared Google Drive “Energy Data” | Utilized in EnPI calculations and compared to average energy usage. | +/5% | Major energy user so need to keep an eye on it to dictate rest of plant’s performance |
| Anaerobic Digestion | Biodigester Gas Production | BioGas Submeters | Weekly | CHP Dept | CHP Rep Calibrates | Increase CHP Electrical Production | Shared Google Drive “Energy Data” | Utilized in EnPI calculations and compared to average energy usage. | +/5% | Important energy producer in the facility (from CHP) thus dictates energy perf. |
| Pumping Mixing | Electricity consumption, flow, MLSS, BOD | SCADA system | Each shift | Operators | Flow meter and lab equipment for MLSS, BOD | Reduce energy intensity | Shared Google Drive “Chem Lab Data” and SCADA | Utilized in EnPI calculations. | +/- 5% | By managing treatment quality at the lowest possible energy for pumping/mixing. |

1. Implement the monitoring, measurement analysis of EnMS performance and the evaluation of EnMS effectiveness.

We performed our compliance evaluations as prescribed under the task guidance for Legal Requirements Affecting the EnMS and all necessary information has been collected.

We initiated the collection, monitoring, measurement and analysis of the information needed to develop trend in the results and have implemented these as an integral part of the compliance evaluation process.

We implemented the monitoring and measurement activities needed to analyze the results related to specific strategic goals and priorities and the achievement of specific intended outcomes.

We have recorded all of our monitoring and measurement activities and are retaining them as documented information.

Hint: Monitoring

* This task draws heavily on information gathered in the Energy Review, so make sure all data is well documented and organized.
* Continual improvement for this task means that there is no set order to monitoring SEUs, relevant variables, action plans, improvement opportunities, and improvement projects.
* Key characteristics can be used to assess the performance of other key characteristics, such that improvement projects can be monitored by evaluating SEU performance.

We are monitoring our implemented projects and have listed details below:

(Note: Table may be modified to accommodate unique criteria)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Implemented Project | When implemented | SEU addressed | Baseline Consumption | Monitoring plan/methods | SEU Performance Improved? | Action Plan changes | Improvement opportunities Identified |
| Replace Current Coarse-Bubble Diffusers with Fine-Bubble Diffusers | 11/15/20 | Aeration | 4.29 mmBtu/MG | BAS System – Aeration Energy Usage | Yes | Updated with progress | None |
| Upgrade Lighting to LED’s | Ongoing | Facilities | 0.15 mmBtu/MG | BAS System – Facilities Baseline | Yes | Updated as progressing | Motion Sensors in Seldom Used Areas |
| Upgrade to Dissolved Oxygen Controls | 1/1/21 | Aeration | 4.29 mmBtu/MG | BAS System – Aeration Energy Usage | TBD | Not yet | TBD |

Top Management Approval

|  |  |  |
| --- | --- | --- |
|  | Date approved: | Jim Doe |
|  | Who approved: | 11/28/20 |

Comments

Click here to enter text.