



**Water In-Plant Training   
Data Collection Sheet**

Company: Example Facility

Location: Oak Ridge, TN

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1. Facility Information

**For PWP Tab 1 Plant Info**

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| --- | --- | --- | --- |
| General Information | | | |
| Corporation Name: | Example Company | **Primary Product:** | Rolled Steel Coils |
| Plant Name: | Example facility | **NAICS 5-Digit Code:** | [33111](https://www.naics.com/naics-code-description/?code=331110) |
| Location: | Oak Ridge, TN | **Industry Subsector:** | [Iron](https://www.naics.com/naics-code-description/?code=331110) and Steel finishing |
| Plant's Safety Protocol: | **NA** | **Industry Type:** | Iron and Steel |
| Comments related to Plant's Water Use: |  |  |  |
| Facility’s Operating Schedule | | **Annual Production Information** | |
| |  |  |  |  | | --- | --- | --- | --- | | Department | Normal Operation  [hours/year] | Downtime  [hours/year] | Comments | | Facility Operation | 8,760 |  | 3 shifts | | HDGL | 8,760 | 180 | 12-20 hr/month outage | |  |  |  |  | |  |  |  |  | |  |  |  |  | | | |  |  |  | | --- | --- | --- | |  |  | Comments | | Year: | 2020 |  | | Product: | Rolled Steel Coils | This includes hot-rolled and galvanized sheets, | | Annual Water Intake: | 373 Mgal | Data obtained from facility | | Annual Production Volume: | 1.27 million tons |  | | Annual Production Cost: | Confidential |  | | |

1. Plant’s Water Flow Diagram

Please review the Sample Water Flow Diagram on the next page and complete your plant’s Water Flow Diagram. Use the following guidance.

|  |
| --- |
| 1. **Define a plant boundary and system boundaries.** 2. **Plant boundary** may be a facility-wide boundary or include specific parts of the facility, depending on its size. 3. For **system boundaries**, list all water-using systems within your plant boundary that you wish to analyze separately. You may segregate or combine processes and systems into manageable groups such that you can quantify water flows across each system boundary.    1. The PWP tool typically accommodates: Process (up to 3), Cooling Tower (up to 3), Boiler (up to 2), Kitchen and Restrooms, Landscaping and Irrigation, Other.    2. Define cooling towers and boilers separate from the processes and facilities they serve.    3. Combine all sanitary water use (i.e., kitchens, restrooms, laundry, etc.) as a single system. 4. **Populate the Master Table.** 5. **List all sources of water intake.** Options: Municipal Water, River or Lake, Ocean or Tide, Groundwater, Rainwater, Other. 6. **List all wastewater discharge outlets.** Options: Municipal Sewer, Third-party Disposal, River or Lake, Ocean or Tide, Groundwater, Onsite Disposal, Stormwater. 7. **List all water treatment processes and wastewater treatment processes**. 8. For each water-using system (A2), indicate which water intake source(s), wastewater discharge outlet(s), water treatment process(es), and wastewater treatment process(es) serve that system. Also, specify the **percent of water flow,** if a system is served by multiple items listed in B1–B3. 9. For each water-using system, mark [x] if the following exists:    1. Water recirculation within a system (such as, in the cooling tower)    2. Water recycled for use in other systems    3. Water used in products    4. Evaporative loss (such as, in the cooling tower)    5. Consumptive loss (such as, in the kitchen for drinking or food preparation, for irrigation, etc.) 10. **Draw a water flow diagram showing all items listed in the Master Table.** 11. Draw **water intake sources** (B1) as boxes on the left. 12. Draw **wastewater discharge outlets** (B2) as boxes on the right. 13. Draw **water-using systems** (A2) as boxes in the middle. 14. Draw **water treatment processes** and **wastewater treatment processes** (B3) as boxes between sources and systems and between systems and wastewater discharge outlets, respectively. 15. Connect C1 through C4 using arrows to indicate water flows. Also, draw arrows to/from each system to indicate water flows identified under B5. 16. Mark annual water flow estimates for all arrows, where available, using:     1. Data from meters and sub-meters,     2. Calculations based on observations, operation records, rules of thumb, etc.,     3. Estimates based on short-term monitoring prior to or spot measurements during Water INPLT. 17. **Refine the water flow diagram, as needed to simplify, by relocating or reordering the boxes and arrows.** |

Sample Water Flow Diagram

|  |
| --- |
| **[C3]**  **[C4]**  **[C4]**  **[C1]**  **[C2]** |

Master Table for the Plant

**For PWP Tabs:**

**1. Plant Info**

**4.** **System Water Balance**

**6. System Water Intake & Discharge**

**7.** **Water & Wastewater Treatment**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **For PWP Tab 1** | **For PWP Tab 6** | | **For PWP Tab 7** | | | **For PWP Tab 4** | | | | |
| **Plant Boundary**  **[A1]** | **Water Intake Source [B1]** | **Wastewater Discharge Outlets [B2]** | | **Water Treatment Process**  **[B3]** | **Wastewater Treatment Process [B3]** | **Water Recirculation within a System** | **Water Recycled for Use in Other Systems** | **Water Used in Products** | **Evaporative Loss** | **Other Consumptive Loss** |
| Whole Facility | 1 1 Lake Water  2. City Water | 1 Industrial Sewer  2. Municipal Sewer | | 1. Chemicals for Cooling Tower  2. Chemicals for Steel Lines  3. Reverse Osmosis | 1. Oily Removal  2. Metals Removal |
| **Water-Using System**  **[A2]** |
| Cooling Tower | 2 | 1 | | 1 | - | x | - | - | x | - |
| Steel treatment 1 & 2 | 1 | 1 | | 2 | 1 | - | - | - | x | - |
| Steel treatment 3 & 4 | 2 | 1 | | - | 1 | - | - | - | x | - |
| Hot Dip Galvanization Line | 1 | 1 | | 3 | 2 | - | - | - | x | - |
| Sanitary | 2 | 2 | | - | - | - | - | - | x | x |
| **Comments:** | | | | | | | | | | |

Plant’s Water Flow Diagram

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1. Plant’s Source Water Intake and Wastewater Discharge

**For PWP Tab 2 Plant Water Intake and Discharge**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1. List all sources of water intake and wastewater discharge outlets from the Master Table. 2. Specify the quality of source water. Options: Potable, Non-potable, Brackish, Saline, Other. 3. Enter monthly data (or annual, if monthly data is unavailable). | | | | | | | | | |
|  | **Inputs for PWP Part 2.1** | | | | | **Inputs for PWP Part 2.2** | | | |
| **Month** | **Plant's Source Water Intake [MGal]** | | | | | **Plant's Wastewater Discharge [MGal]** | | | |
| Source 1:  Lake Water | | Source 2:  City Water | Source 3: | | Outlet 1: Industrial Sewer | Outlet 2: Domestic Sewer | | Outlet 3: |
| Quality: | | Quality: | Quality: | |
| January | 15.4 | 13.1 | |  | 22.9 | | 0.2 |  | |
| February | 27.7 | 23.5 | |  | 41.2 | | 0.2 |  | |
| March | 15.6 | 13.3 | |  | 23.1 | | 0.2 |  | |
| April | 12.0 | 10.2 | |  | 17.7 | | 0.2 |  | |
| May | 14.1 | 12.0 | |  | 20.8 | | 0.2 |  | |
| June | 13.9 | 11.8 | |  | 20.6 | | 0.2 |  | |
| July | 10.9 | 9.2 | |  | 16.0 | | 0.2 |  | |
| August | 10.3 | 8.8 | |  | 15.3 | | 0.2 |  | |
| September | 16.4 | 13.9 | |  | 24.3 | | 0.1 |  | |
| October | 19.7 | 16.7 | |  | 29.2 | | 0.2 |  | |
| November | 21.0 | 17.8 | |  | 31.2 | | 0.1 |  | |
| December | 25.2 | 21.4 | |  | 37.5 | | 0.2 |  | |
| ANNUAL TOTAL | 202.2 | 171.7 | |  | 299.8 | | 2.1 |  | |
| **Comments:** | | | | | | | | | |

1. Data Collection for Water Balance: Metered Data

**For PWP Tabs:**

**4.** **System Water Balance**

| 1. List all sources of water-using systems as identified in the water flow diagram and master table. 2. Enter the measured/estimated water intake and discharge along with the losses and recycled water consumption. 3. Losses can be estimated as a percentage of the intake or discharge. 4. If using engineering estimates from the calculators available in the PWP tool, skip the corresponding row for that specific water user and fill out its information in section 5. | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Inputs for PWP Part 4.1** | | | **Inputs for PWP Part 4.2** | | |  |
| **Water-Using System** | **Gross Water Use [MGal]** | | | **System Water Outflow [MGal]** | | | **Comments** |
| **Water Intake** | **Recycled From Other Systems** | **Recirculated Water** | **Wastewater Discharge** | **Recycled To Other Systems** | **Consumptive Loss** |
| HDGL (for product cooling) | 76.1 | - | - | 95% of intake | - | 5% of intake | Intake is Metered, losses are estimated |
| Steel Treatment (line 1 and 2) | - | - | - | 90% of intake | - | 10% of intake | Can be determined from water balance |
| Steel Treatment (line 3 and 4) | - | - | - | 90% of intake | - | 10% of intake | Same water consumption as lines 1 and 2 |
|  |  |  |  |  |  |  |  |
| Cooling Tower | 46.4 | - | Estimated as per section 5 | 9.1 | 0 | 37.3 | Intake is metered; blowdown calculated from cycles of concentration |
| Sanitary Use | Estimated as per section 5 |  |  | Estimated as per section 5 |  |  |  |

1. Data Collection for Water Balance: Information for Engineering Estimate

**For PWP Tabs:**

**3. Water Use Calculations**

The information requested below are used to determine the water intake and discharge using the optional calculators built into the PWP tool. While performing an engineering estimate is not needed if accurate metered data is available (section 4), engineering estimates can be a way to double check the metered data as well.

| **Process Water Use**   * **A process** specified as a water-using system in the Master Table **may be a group of multiple process applications**, which may have different water requirements. Therefore, describe each process applications separately and specify which **process group** it belongs to. * Notes: Specify units from the following options:   1Unit: Gallon, Gallon per Production Unit, or Gallon per Hour  2Unit: Gallon, Gallon per Production Unit, Gallon per Hour, Fraction of Incoming Water, or Fraction of Gross Water Use | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Inputs for PWP Part 3.1** | | | | | | | |
| **Process Description** | **Water Required for Processing**  **[1Unit: gal/ton ]** | **Process Water Consumed in Product**  **[2Unit: \_\_\_\_\_\_\_\_\_\_\_]** | **Process Water Losses (Evaporation/ Other)**  **[2Unit: \_\_\_\_\_\_\_\_\_\_\_ ]** | If Gallon per Production Unit specified, enter | If Gallon per Hour specified, enter | **Fraction of Gross Water Use Recirculated** | **Comments** |
| **Production Units per Year: tons** | **Hours Water Used per Year** |
| HDGL (for product cooling) |  |  | - | - |  |  | Metered data available |
| Steel Treatment (line 1 and 2) | 97 |  | 10% of total intake | 1.27 million |  |  | Estimates to cross check values from water balance |
| Steel Treatment (line 3 and 4) | 97 |  | 10% of total intake | 1.27 million |  |  | Estimates to cross check values from water balance |

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| **Cooling Tower Water Use**   * A **cooling tower system** specified as a water-using system in the Master Table **may consist of one or more cooling towers** of different size, performance, and hours of operation. Therefore, describe each cooling tower separately and specify which **cooling tower system** it belongs to. * Notes:   1Load Factor (average cooling load per tonnage): Typical range is 0.5-0.8.  2Temperature Drop Across Cooling Tower: Typical range is 10-15°F at 85°F wet-bulb temperature.  3Obtain conductivity from records, blowdown control device, or a handheld conductivity meter.  4Conductivity unit options: mmho, TDS ppm, μS/cm, ms/cm. | | | | | | | | | |
| **Inputs for PWP Part 3.2** | | | | | | | | | |
| **Cooling Tower Description** | **Hours of Operation per Year** | **Cooling Tower Tonnage** | | **1Load Factor**  **[Fraction of Tonnage]** | **2Temp. Drop Across Cooling Tower [°F]** | **3Conductivity**  **[4Unit: μS/cm]** | | | **Comments** |
| **Makeup Water** | | **Blow-down** |
| Cooling Tower | 8760 | 5000 | 0.6 | | 10 | | 100 | 525 | Estimates to cross check metered values |
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| **Boiler Water Use**   * A **boiler system** specified as a water-using system in the Master Table **may consist of one or more boilers** of different size, performance, and hours of operation. Therefore, describe each boiler separately and specify which **boiler system** it belongs to. * Notes:   1Load Factor (average heating load per boiler horsepower): Typical range is 0.5-0.8  2Steam Generation Rate per Horsepower is 34.5 lb/h at 212°F  3Obtain conductivity from records, blowdown control device, or a handheld conductivity meter.  4Conductivity unit options: mmho, TDS ppm, μS/cm, ms/cm | | | | | | | | |
| **Inputs for PWP Part 3.3** | | | | | | | | |
| **Boiler Description** | **Hours of Operation per Year** | **Boiler HP** | **1Load Factor**  **[Fraction of Boiler HP]** | **2Steam Generation Rate [lb/h] per HP** | **3Conductivity**  **[4Unit:]** | | | **Comments** |
| **Feedwater** | **Makeup Water** | **Blow-down** |
| NA |  |  |  |  |  |  |  |  |

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| **Sanitary Water Use**   * You may describe multiple employee groups based on work hours. * For "Daily Water Use per Employee," consider a typical range of 10-35 gallon per shift. The lower value is used when there are just toilets. A higher value is used where there are toilets, showers, and full kitchen services (e.g., food preparation and dishwashing). | | | | |
| **Inputs for PWP Part 3.4** | | | | |
| **Sanitary Use Description** | **Number of Employees** | **Workdays per Year** | **Daily Water Use per Employee [Gal]** | **Comments** |
| Sanitary Uses | 150 | 365 | 35 |  |
|  |  |  |  |  |

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| **Landscaping and Irrigation Water Use**  You may describe multiple irrigated land areas or combine them as one area. Include irrigation water from water intake sources as well as recycled from other systems. | | | |
| **Inputs for PWP Part 3.5** | | | |
| **Description (Lot Name)** | **Area of Land Irrigated [sqft]** | **Inches of Irrigation Water per Year** | **Comments** |
| NA |  |  |  |
|  |  |  |  |
|  |  |  |  |

1. Data Collection for True Cost of Water: Heat Energy in Wastewater

**For PWP Tab 8 Embodied Energy**

| **Inputs for PWP Part 8.1** | | | | |
| --- | --- | --- | --- | --- |
| * Describe all high temperature wastewater discharge. For example, boiler blowdown, condensate discharge, and process cleaning/sanitizingusing hot water or steam. * The source water temperature may have seasonal variation. Enter annual average temperature for the incoming source water. | | | | **Efficiency of Water Heating System [Fraction]** |
|  |
| **Water-Using System** | **Water Temperature [°F]** | | **Comments** | |
| **Incoming Source Water** | **Outgoing Wastewater** |
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1. Data Collection for True Cost of Water: Pump, Fan and Motor Energy Use

**For PWP Tab 8 Embodied Energy**

| * Describe all pumps, fans, and other motor-driven equipment associated with water in the **water-using systems** as well as **water and wastewater treatment systems**. * For **water and wastewater treatment systems**, calculate the energy use in the comment section using the following equation. Account for these values to calculate the unit cost of water and wastewater treatment systems in section 9.   *Energy Use (kWh) = (0.746 \* Motor Horsepower \* Number of Pumps Fans or Motor \* Load Factor / Efficiency) \* Hours of Operation per Year* | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Inputs for PWP Part 8.2** | | | | | | | |
| **Water-Using System** | **Pump, Fan or Motor Description** | **Number** | **Hours of Operation per Year** | **Load Factor [Fraction of Motor Horsepower]** | **Horsepower** | **Efficiency [%]** | **Comments** |
| Lake water pump station |  | 2 | 8760 | 0.7 | 100 | 0.80 |  |
| Cooling tower recirculation pumps |  | 2 | 8760 | 0.7 | 100 | 0.80 |  |
| Cooling tower fans |  | 2 | 8760 | 0.7 | 20 | 0.80 |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
| **Water and Wastewater Treatment System** | **Pump, Fan or Motor Description** | **Number** | **Hours of Operation per Year** | **Load Factor [Fraction of Motor Horsepower]** | **Horsepower** | **Efficiency [%]** | **Comments** |
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1. Unit Costs: Utilities

**For PWP Tab 5 Unit Costs**

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| * For utilities that have fixed costs associated, determine the annual average unit cost dividing the total cost incurred in a year by the quantity of water, wastewater, or fuel it was charged for. | | | |
| **Inputs for PWP Part 5.1** | | | |
| **Utility** | **Unit** | **Unit Cost** | **Comments** |
| Municipal Water Intake – Rate 1 | $ per kGal | 1.72/kGal |  |
| Municipal Water Intake – Rate 2 | $ per kGal |  |  |
| Municipal Water Intake – Rate 3 | $ per kGal |  |  |
| Municipal Wastewater Disposal – Sanitary Sewer | $ per kGal | 1.24/kGal |  |
| Municipal Wastewater Disposal – Industrial Sewer | $ per kGal | $2/kGal |  |
| Stormwater Discharge | $ per kGal |  |  |
| Third-party Disposal | $ per kGal |  |  |
| Electricity | $ per kWh | $0.05/kWh |  |
| Heating Fuel | $ per MMBtu |  |  |

1. Unit Costs: Water and Wastewater Treatment Processes

**For PWP Tab 5 Unit Costs**

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| * Obtain or calculate annual average costs per unit for water and wastewater treatment processes. * As applicable, add the annualized costs of chemicals, pumping and motor energy (from Section7), maintenance, labor, installation, etc., divided by the amount of water and wastewater treated. | | |
| **Inputs for PWP Part 5.2** | | |
| **Water Treatment Process** | **Unit Cost**  **[$ per kGal]** | **Comments** |
| Chemicals for Cooling Tower | $0.195/kGal |  |
| Chemicals for Steel Lines | $0.114/kGal |  |
| RO System | $0.33/kGal |  |
|  |  |  |
|  |  |  |
| **Wastewater Treatment Process** | **Unit Cost**  **[$ per kGal]** | **Comments** |
| Metal wastewater treatment | $1.46/kGal |  |
| Oily wastewater treatment | $0.06/kGal |  |
|  |  |  |
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|  |  |  |