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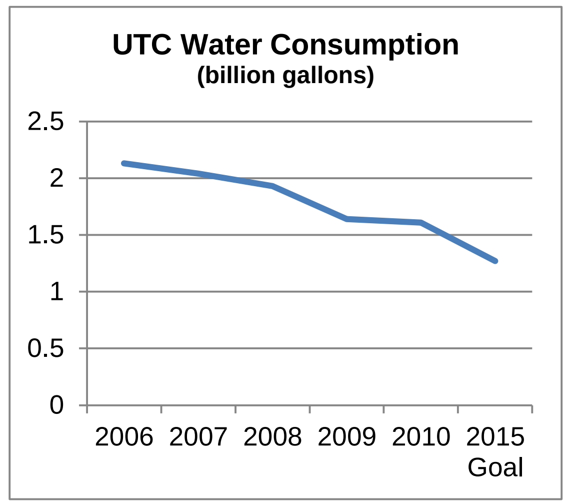
GLOBAL WATER CONSERVATION GUIDANCE DOCUMENT

Water use has always been an important part of UTC's Environment Health and Safety conservation goals. From a global perspective, population growth and shortages of renewable fresh water supply necessitates that sustainability planning include water management best practices. In addition to being inextricably linked to energy and climate change, water supply issues have the potential to significantly impact how and where manufacturing sites operate. UTC has a long and successful history of implementing water conservation projects. Since 2006 UTC has reduced annual water consumption 33%.

In addition to local water supply classification sites should be aware of other risk factors such as local water quality conditions. Water quality statistics are typically published by water suppliers or municipalities. Other risk factors include rising cost and increased regulatory requirements on water quality.

This guidance document provides details of UTC's global water scarcity assessment and best practices in managing water risks for the corporation and its supply chain. You will also find case studies and example projects that have been successfully implemented at UTC sites.



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This document contains no information that is subject to the EAR or ITAR

CURRENT STATE ASSESSMENT

Unlike greenhouse gas emissions, water issues vary dramatically by geographic region and need to be managed accordingly. Utilizing the World Business Council for Sustainable Development (WBCSD) *Water Tool*, UTC was able to map water supply and assess risks relative to our global operations.

Regional water resources are classified by the WBCSD Tool into one of five water supply categories: ***Abundant, Sufficient, Stressed, Scarce*** **or** ***Extremely Scarce***. The tool was used to compare UTC sites with validated water and sanitation data on a country and watershed basis.

BASELINE CONSUMPTION AND WATER BALANCE

An important part of understanding a site's water consumption baseline is having an awareness of local water supply conditions. To that end, each site should know the water supply category for their location as defined by the WBCSD Water Tool **(*Abundant, Sufficient, Stressed, Scarce*** **or** ***Extremely Scarce).*** Each site should also understand their trend in annual water use and evaluate the conservation initiatives as outlined in the "Best Practices" section below.

1. Using data from water utility meter reading and/or sub-metering, establish a ***baseline*** for the site's water consumption.
2. Develop a documented process to create and maintain a ***water balance*** diagram at the lowest level possible for the site.
   Include water flow for:
   - Municipal water in;
   - Other water brought into the facility (groundwater, surface waters);
   - Consumption in all processes, including non-contact cooling, cooling towers and boilers;
   - Treated wastewater and resulting waste;
   - Evaporation and sanitary wastewater;
   - Water released to sanitary sewers.

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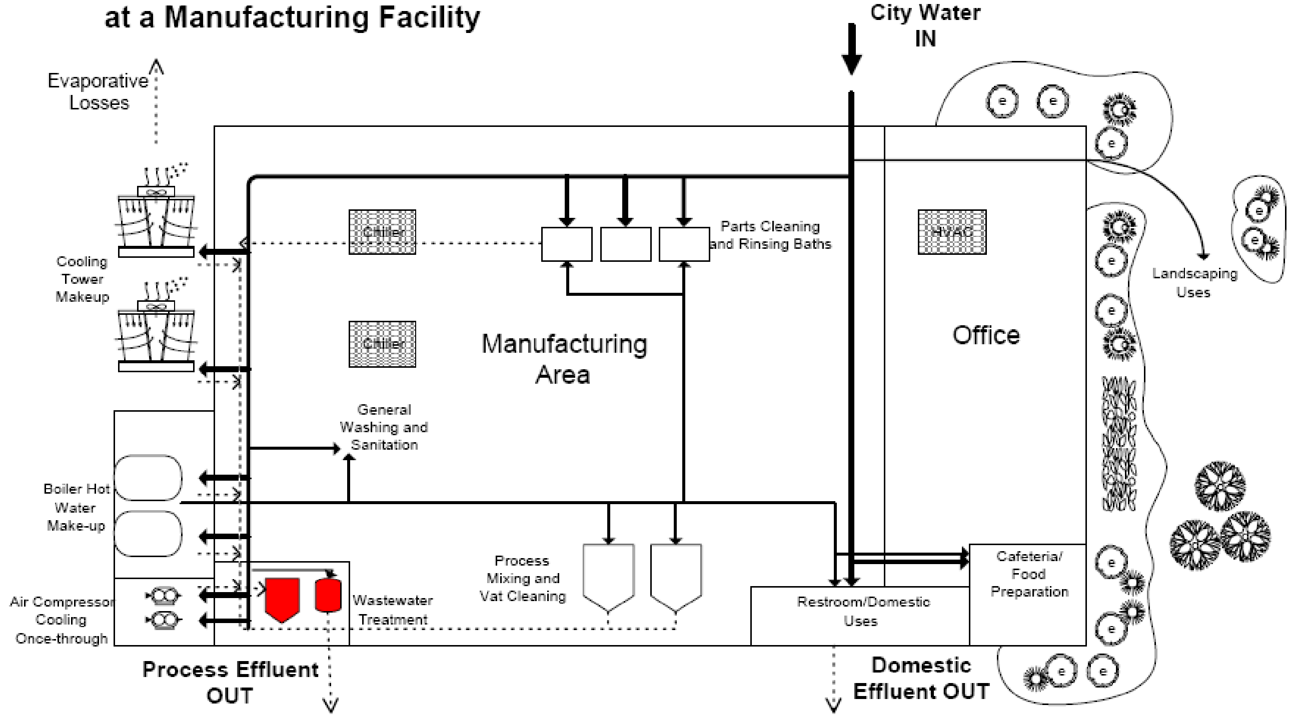
Simplified Water Balance at a Manufacturing Facility



Water Balance Summary

Sources of water use	Gallons per year	Percent of total
Cooling: tower make-up and boiler make-up	7,966,000	38.3
Process use: parts and mixing vat cleaning	3,848,000	18.5
Domestic: faucets, toilets and showers	3,536,000	17
Once-through cooling: air compressors and pumps	2,388,000	11
Landscaping	832,000	4
General washing, sanitation and maintenance	561,600	2.7
Leaks (detected)	416,000	2
Food preparation: dishwasher	312,000	1.5
SUBTOTAL	19,859,000	95.5
TOTAL WATER PURCHASED	20,800,000	100.0
UNACCOUNTED FOR	941,000	4.5

N.C. Department of Environment and Natural Resources Water Efficiency Manual

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CONTINIOUS IMPROVEMENT (Key areas to focus on)

1. Develop a process to review water consumption quarterly. The process must include:

a. A comparison to the same period in the previous year and a determination of percent deviation from that period. This comparison may include metered data for the facility and sub-meters installed on individual processes or areas of the facility;

b. When the deviation is greater than 10% for several months or if it is significant (>20% during a single quarter), complete an evaluation of the source(s) of the deviation by reviewing:

- Any process modifications;
- Production rates specific to water-related processes (sub-metered data can be used);
- Process equipment failure including water meters;
- Changes in staffing levels;
- Changes in wastewater discharges;

Key areas to check during a walk-through survey

Process and Equipment Use
- Cleaning, washing, rinsing
- Metal finishing
- Painting
- Dyeing and finishing
- Photo processing
- Reuses
- Product fluming (water transport)
- Water use in products

Cooling and Heating
- Single-pass cooling
- Cooling tower/chillers
- Boiler, hot water, steam systems
- Air washers
- Boiler scrubber

Sanitary and Domestic
- Toilets
- Urinals
- Faucets
- Showers
- Wash-up basins

Kitchen Food
- Cafeteria uses
- Dishwashers
- Ice machines
- Faucets

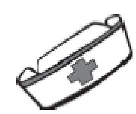
Other Facility Support
- Floor washing
- Air emission wet scrubbers
- Building washing
- QA/QC testing
- Laboratories
- Wastewater treatment

Outdoor Uses
- Landscaping
- Irrigation
- Particulate emission control

Decorative fountains/ponds

Vehicle washing

Personnel
- Medical



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REQUIRED ACTIONS

Water reduction initiatives should be scalable to match local conditions. Sites will review the best practices listed below for applicability and will develop an implementation plan for the water management best practices that are considered practical. Project details will be tracked in the EH&S Project Tracking Module.

Water Management Best Practice Tracking

Best Practice for Existing Sites	Project Complete	Developing - Implementing	Not Started	Considered Not Recommended
Water Balance				
Leak management program				
Eliminate once-through cooling				
Implement cooling tower management program				
Install flow meters				
Install low flow fixtures				
Reduce or eliminate rinse tank overflow				
Reduce or eliminate landscape irrigation				
Recycle process wastewater				
Rain water harvesting				

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MINIMUM EXPECTATIONS FOR BEST PRACTICES

Water Balance per Standard Practice 009.

A Water Balance shall be prepared that illustrates the volumetric flow rate of all water used including sources that are not defined as a Significant Water Source (e.g. sanitary, cafeteria, blow down from cooling towers and boilers and mop water) and all Significant Water Sources. The Water Balance shall also indicate where wastewater is treated and/or recycled. The volume of water discharge from all water sources at the facility shall be measured using influent and/or discharge water meters. The volume of water consumed (from all sources public water supplies or on-site diversions) and discharged shall be evaluated annually to ensure that the sources of all significant changes are identified.

Water leak management program

All facilities will experience some water leaks. Leaks may range from a fraction of a percent up to several percents of total water use. Common locations to find leaks are in piping joints, restroom fixtures, pump seals, hose nozzles/shut off valves, drinking fountains, processing equipment, and other locations. Eliminating leaks typically includes tightening or replacing fitting. Leaks can be identified via visual or auditory observation. Water fixtures and process equipment should be observed during both use and down time. All employees should be responsible for notifying maintenance personnel of leaks. Underground and under-the-floor leaks can be detected through a leak detection survey. If an underground leak is suspected, but not identified, facilities should consider having a leak detection survey conducted by a consulting or service firm.

Quantifying the volume of water lost through leaks is important for determining the potential water and cost savings of leak repair. One of the simplest methods to determine leak loss is the bucket and stopwatch method. A small drip also can be measured by the bucket and stopwatch method. Mathematical estimates of leaks also can be used.

Eliminate once-through cooling

For many years it was a common practice to use municipal water in once-through or single-pass cooling systems for various HVAC and process cooling applications. Single-pass cooling systems are ineffective and waste water. All single-pass cooling systems should be replaced with air-cooled or recirculating systems.

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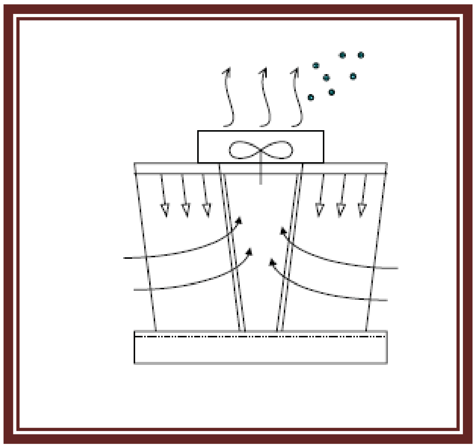

Cooling tower management program

In many facilities cooling towers can represent one of the largest consumers of water and offer one of the best opportunities for water conservation. Proper management of cooling tower operation will result in water savings, sewer savings and chemical treatment savings. Specific items to address are; evaporation rates, drift, blow down, basin leaks, water chemistry and cycles of concentration. In addition to carefully controlling tower operations, other water efficiency opportunities arise from using alternate sources of make-up water. Sometimes water from other equipment within a facility can be recycled and reused for cooling tower make-up with little or no pre-treatment.

Install flow meters

Installing flow meters on large process loads and significant water consumers help track and manage water use. While meters alone do not save water, they do allow for careful monitoring of usage and can identify water use trends, waste, leaks and system failures.

Install low flow fixtures and flow restrictors

Modern plumbing fixtures use significantly less water than conventional designs. Consider replacing old plumbing fixtures with new ones. Equipment design guidelines should include dual flush water closets, 0.125 gallon per flush urinals, 0.5 gallons per minute lavatory fixtures, 1.5 gallons per minute kitchen fixtures and 1.5 gallon per minute showers.
The use of flow restrictors in the feed line to a tank is a very effective means to ensure excessive water is not fed to the process line. The restrictor flow rate should be chosen to provide sufficient water for quality rinsing.

Reduce or eliminate rinse tank overflow.

It is a common practice to use rinse tank overflow as a way to keep rinse tanks full and clean. The water flow to rinse tanks should be turned off when process lines are not in use. This can be done manually or automatically.

Another option is to control water flow to rinse tanks through the use of conductivity sensors. Conductivity sensors can measure the concentration of contaminates in the rinse water and cycle the water accordingly.

Reduce or eliminate landscape irrigation (Xeriscaping)

Site landscaping should be designed to minimize water consumption by using local plants or natural landscaping that do not require irrigation.
Consider the use of captured rainwater or recycled wastewater for irrigation. If irrigation is necessary, use control systems that monitor rainfall amounts and or soil moisture conditions instead of allowing irrigation systems to operate on a time schedule.

Waste water treatment unit at HS Maastricht

Recycle process wastewater

A thorough water balance should quantify water use for the large water consuming industrial processes. The water quality requirements for each process should also be noted. This information can be used to identify water recycling opportunities such as cooling tower blow down that can be used in scrubber applications. Process wastewater can also be filtered and reused in the same process.

Rainwater harvesting

Rainwater harvesting is the accumulating and storing, of rainwater for reuse, before it reaches the aquifer. Rainwater harvesting systems can be simple to construct from inexpensive materials. Although some rooftop runoff may produce rainwater that is harmful to human health, it can be useful in flushing toilets, washing cars, landscape watering and washing parts.