Water Management Plan

Revision 1

United States Environmental Protection Agency
Andrew W. Breidenbach Environmental Research Center and Child Development Center
26 West Martin Luther King Drive
Cincinnati, Ohio 45268

30 September 2009

Point of Contact:
Richard Koch, Director, Facilities Management Services Division
513-569-7902

EPA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
ANDREW W. BREIDENBACH ENVIRONMENTAL RESEARCH CENTER AND CHILD DEVELOPMENT CENTER
CINCINNATI, OHIO

WATER MANAGEMENT PLAN

Approved by:

Richard D. Koch, Director, Facilities Management and Services Division — 9/30/09 Date

TABLE OF CONTENTS

Page

LIST OF TABLES

Page

1.0 EPA'S STATEMENT OF PRINCIPLES ON EFFICIENT WATER USE

In order to meet the needs of existing and future populations and ensure that habitats and ecosystems are protected, the nation's water sources must be sustainable and renewable. Sound water resource management, which emphasizes wise, efficient use of water, is essential to achieve these objectives.

Efficient water use can have major environmental, public health, and economic benefits by helping to improve water quality, maintain aquatic ecosystems, and protect drinking water resources. As we face increasing risks to ecosystems and their biological integrity, the inextricable link between water quality and water quantity becomes more important. Water efficiency is one way of addressing water quality and quantity goals. The efficient use of water can prevent pollution by reducing wastewater flows, recycling process water, reclaiming wastewater, and using less energy. As municipalities and regions deal with chronic drinking water shortages due to drought and changes in climate patterns, water conservation becomes even more important to the sustainability of our mission.

EPA recognizes that regional, state, and local differences exist regarding water quality, quantity, and use. Differences in climate, geography, and local requirements influence the water efficiency programs applicable to specific facilities. Therefore, EPA is establishing facility-specific Water Management Plans to promote the efficient use of water and meet the water conservation requirements under Executive Order (EO) 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*.

This Water Management Plan has been established to document and promote the efficient use of water at the U.S. EPA Andrew W. Breidenbach Environmental Research Center (AWBERC) and Child Development Center (CDC) in Cincinnati, Ohio. The plan is organized according to the Federal Energy Management Program (FEMP) Facility Water Management Planning Guidelines.

2.0 FACILITY DESCRIPTION

AWBERC is located on 22 acres donated by the City of Cincinnati, adjacent to the main campus of the University of Cincinnati and near a major hospital and medical research complex. The ten-story facility opened in 1976 and is owned and operated by EPA.

Internationally recognized for water research, the center has also become a leader in bioremediation, pollution prevention, and superfund research. Through this Center, EPA also provides public education and training on the environment and emergency response. The Center is one of two major EPA research centers in the United States, and houses state-of-the-art research laboratories, training facilities, and administrative offices.

Research activities for several EPA national laboratories are conducted at AWBERC, including the National Exposure Research Laboratory, the National Risk Management Research Laboratory, the National Homeland Security Research Center, and the National Center for Environmental Assessment.

AWBERC contains laboratory spaces equipped for chemistry and biology research, including animal containment rooms and an aquatic culture unit. Laboratory spaces are interspersed with

office and general use space throughout the building. Boilers, chillers, air handling units, and other main mechanical equipment are located in a basement mechanical room. A 5,000-ton condenser water cooling tower is located in a below grade cut-out on the east side of the main building. An additional cooling tower is mounted on the roof to provide year-round, recirculated cooled water to equipment located throughout the building. A one-story full containment laboratory is located adjacent to the main building, on the north side.

A three-story research support annex (Annex 1) was added to the northwest corner of the main building and occupied in September 2004. Annex 1 was built to provide additional office space and allowed some of the space in the main building to be converted from offices to research laboratories.

EPA added another research support annex (Annex 2). The north wing of Annex 2 was completed and occupied in September 2007, and the west wing was completed and occupied in January 2008. Annex 2 has received the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED®) Gold-level certification for new construction. At the time of the water assessment, half of Annex 2 was being used as permanent office space for AWBERC staff, and the other half was serving as temporary "swing space" during a major Infrastructure Replacement Project (IRP). The IRP is a multi-year, multi-phase, multi-million-dollar project that will replace all of the air handling units, vertical and horizontal supply ductwork, control systems, exhaust systems, and associated equipment at AWBERC. Eventually, Annex 2 will house additional, permanent office space to allow space in the original AWBERC tower to be converted to new laboratory space.

Also located on the AWBERC campus is the CDC. CDC, built in the late 1980's, provides care and education for young children of EPA employees at the AWBERC facility. CDC has several classrooms and an outdoor playground.

The main building, containment laboratory, and annex buildings contain 429,646 square feet of conditioned space. The CDC contains 5,904 square feet of conditioned space.

3.0 FACILITY WATER MANAGEMENT GOALS

The water management goals of EPA Cincinnati[1] are achieved through the implementation of an Environmental Management System (EMS). The environmental policy statement and EMS aspects and targets related to water management are included in the following sections.

Comprehensive Environmental Management Implementation Policy

The Mission of EPA is to protect human health and environment. The Agency accomplishes this mission by developing and enforcing regulations implementing environmental laws enacted by Congress, providing assistance to others charged with reducing and preventing pollution, and by conducting environmental research.

[1] EPA Cincinnati refers to all EPA facilities in Cincinnati, Ohio including AWBERC, CDC, the Center Hill Facility, and the Testing and Evaluation Center.

In support of this mission EPA Cincinnati is committed to Environmental Stewardship. To accomplish this we must properly manage the environmental impacts of our own operations and facilities.

EPA Cincinnati is one of the Agency's largest research operations. Accordingly, we recognize our obligation and opportunity to provide leadership in protecting the environment, addressing emerging environmental issues, advancing science and technology of risk assessment and risk management, and promoting environmental education.

EPA Cincinnati is committed to reducing the environmental impacts of our operations and limiting our natural resource consumption. Our EMS will address the following goals:

- Maintain a collaborative EMS that covers the EPA organizations in Cincinnati;
- Ensure compliance by meeting or exceeding all relevant environmental requirements to which we subscribe;
- Seek to continually reduce the environmental footprint of EPA Cincinnati;
- Consider environmental impacts in planning, constructing and operating facilities;
- Incorporate source reduction and pollution prevention into research activities;
- Establish, track and review environmental performance goals; and
- Share information about our EMS with interested parties.

Environmental Management System Aspects, Objectives and Targets

EPA Cincinnati has identified water management as a significant environmental aspect, in view of the Executive Order 13423 requirement that federal agencies reduce their overall water use intensity, measured on a gallon per square foot (gallons/gsf) basis, by 2 percent per year compared to a 2007 baseline, for a total of 16 percent reduction by 2015. In September 2008, EPA Cincinnati established an objective to support the Agency's effort to reduce water consumption from a fiscal year (FY) 2007 baseline.

EPA Cincinnati's specific target under this objective is to support the Agency's overall water intensity reduction goal by meeting facility-specific water intensity reduction targets issued annually by EPA's Sustainable Facilities Practices Branch at EPA Headquarters.

EPA Cincinnati defines the status indicator of this objective and target as actual water used. Under this plan, annual water usage after implementation of Best Management Practices (BMPs) will be compared to the baseline water usage data to determine if the targeted reductions are being achieved.

4.0 UTILITY INFORMATION

Contact Information

Potable water is provided by:

City of Cincinnati
Greater Cincinnati Water Works
4747 Spring Grove Avenue
Cincinnati, Ohio 45232

Phone: 513-591-7700

Sewage service is provided by:

Metropolitan Sewer District of Greater Cincinnati
1600 Gest Street
Cincinnati, OH 45204

Phone: 513-352-4900

Rate Schedule

Monthly and quarterly water billing is based on a tiered rate structure, provided in Table 1.

Table 1. Water Use Fee Structure (effective 16 January 2009)

Facility	AWBERC	Annex 2	Child Care
Monthly Fee Structure			
Monthly Water Meter Fee	$194.81	$52.03	NA
First 20 ccf water use	$1.89/ccf	$1.89/ccf	NA
Next 580 ccf water use	$1.50/ccf	$1.50/ccf	NA
Over 600 ccf water use	$1.33/ccf	$1.33/ccf	NA
Quarterly Fee Structure			
Quarterly Water Meter Fee	NA	NA	$62.59
First 60 ccf water use	NA	NA	$1.89/ccf
Next 1740 ccf water use	NA	NA	$1.50/ccf
Over 1800 ccf water use	NA	NA	$1.33/ccf

The monthly and quarterly billing for sewer use is also on a tiered rate structure, provided in Table 2.

Table 2. Sewer Use Fee Structure (effective 9 January 2009)

Facility	AWBERC	Annex 2	Child Care
Monthly Fee Structure			
First 5 ccf sewer use	Flat fee of $973.58 per month	Flat fee of $300.51 per month	NA
Next 45 ccf sewer use	$3.849/ccf	$3.849/ccf	NA
Over 50 ccf sewer use	$3.078/ccf	$3.078/ccf	NA
Quarterly Fee Structure			
First 9 ccf sewer use	NA	NA	Flat fee of $326.91 per quarter
Next 141 ccf sewer use	NA	NA	$3.849/ccf
Over 150 ccf sewer use	NA	NA	$3.078/ccf

At AWBERC, the sewer use fee is based on total metered water usage, minus water used for systems that introduce little to no pollutant load to the sewer. The quantity of flow subtracted from the total water use is based on sewage deduct meters installed on the following equipment water supply lines: two cooling tower make-up water lines, the emergency generator, and boiler make-up. The sewage authority has indicated a desire to phase out the sewage use deduction over time.

The storm water fee is $15.73 per day.

Payment Office

Utility bills are paid by bank card by Chris Hutcherson (513-569-7262) at Cincinnati AWBERC.

(Pouch and Regular Mail)
Environmental Protection Agency
Mail Code – 271
Cincinnati, OH 45268

(FEDEX)
Environmental Protection Agency
Mail Code – 271
26 Martin Luther King Drive W
Cincinnati, OH 45268

5.0 FACILITY WATER USE INFORMATION

AWBERC is a diversified environmental research center with a mixed use office and laboratory space. Laboratory activities span a range of chemical and biological disciplines, and the facility houses small mammal rooms and an aquatic culture system to support research activities. Water

uses include potable water and high-purity deionized water supplied for laboratory purposes, water supplied to building mechanical systems, and domestic water used in the kitchen and for building sanitation. The facility has discontinued the use of its irrigation system; therefore, virtually no water is used for landscape irrigation.

Major Water-Using Processes

Average water use in FY 2008 by major process at AWBERC and CDC is shown in Tables 3 and 4, respectively.

Table 3. Major Water-Using Processes, AWBERC

Major Process	Annual Consumption (gallons)	Percent of Total	Comments
Main building and Annex 1 sanitary	3,750,000	12.9	Engineering estimate
Annex 2 sanitary	209,679	<1	Metered
Cafeteria operation	230,000	<1	Engineering estimate
Cooling tower (main)	5,053,200	17.4	Metered
Cooling tower (roof #1)	675,738	2.3	Metered
Cooling tower (roof #2)[2]	353,941	1.2	Metered
Boiler make-up	2,418,287	8.3	Metered
Air compressor cooling	0	0.0	Eliminated
Vacuum pump seal water	208,000	<1	Metered
Domestic cold water booster pump cooling	300,000	1.0	Engineering estimate
Kitchen ice maker cooling	300,000	1.0	Engineering estimate
Emergency generator cooling	27,087	<1	Metered
Aquatic culture water	2,938,983	10.1	Metered
Vivarium cage and bottle washing	81,000	<1	Engineering estimate
Animal room wash down	20,000	<1	Engineering estimate
Steam sterilizers	1,300,000	4.5	Engineering estimate
RO reject water	53,000	<1	Engineering estimate
Boiler blowdown flash tank tempering water	1,500,000	5.2	Engineering estimate
Kill tank discharge cooling water	120,000	<1	Engineering estimate
Miscellaneous laboratory and other uses	9,472,225	32.7	Calculated by difference
Total	**29,011,140**	**100.0**	**Metered**

[2] This cooling tower was taken out of service in June 2009, but is still included in the FY 2008 water balance since it was in use at that time.

Table 4. Major Water-Using Processes, CDC

Major Process	Annual Consumption (gallons)	Percent of Total	Comments
Sanitary	146,860	74.2	Calculated by difference
Clothes washer	50,000	25.3	Engineering estimate
ENERGY STAR dishwasher	1,000	<1	Engineering estimate
Total	**197,860**	**100.0**	**Metered**

Additional detail on assumptions and calculations supporting these water use estimates are provided in Appendix A. Graphs of FY 2008 water use for AWBERC, Annex 2, and CDC can be found in Appendix B.

Measurement Devices

Incoming city water supply is metered. Flow totalizing meters are also installed on many of the major subsystem flows. An inventory of metered flows is provided below:

- City water supply to main AWBERC building
- City water supply to Annex 2
- City water supply to CDC
- Cooling tower make-up, main
- Cooling tower make-up, roof #1
- Boiler make-up
- Emergency generator cooling

Flow totalizer readings are recorded monthly and reported to the facilities management staff. Water use trends are monitored on an ongoing basis and unexpected changes in water use are investigated and resolved.

Shut-off Valves

City water supply line shutoffs are located in the main mechanical room on the basement level in the main AWBERC building, the mechanical room on the basement level in the Annex 2 north wing, and the mechanical closet in CDC.

Occupancy and Operating Schedules

Approximately 850 employees work at AWBERC, and approximately 14 adults and 41 children occupy the CDC. The facility operates on a flex time schedule and is typically occupied between 6 a.m. and 6 p.m., Monday through Friday.

6.0 Best Management Practice Summary and Status

Former President Bush established Water Reduction Goals under Executive Order 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*. Under the

Executive Order, Agencies must establish a FY 2007 water use baseline, and then reduce water use intensity by two percent annually through the end of FY 2015, for a total reduction of 16 percent. This goal is incorporated into the EPA Cincinnati EMS, as noted above. Facilities should implement BMPs related to water use, considering life-cycle cost effectiveness, to achieve these water reduction goals. The Federal Energy Management Program (FEMP) has identified BMPs in 14 possible areas to help facilities identify and target water use reductions. AWBERC and CDC have adopted BMPs in eight of the areas, as checked below:

- ☑ Water Management Planning
- ☑ Information and Education Programs
- ☑ Distribution System Audits, Leak Detection and Repair
- ☑ Water-Efficient Landscaping
- ☑ Water-Efficient Irrigation
- ☐ Toilets and Urinals
- ☑ Faucets and Showerheads
- ☐ Boiler/Steam Systems
- ☐ Single-Pass Cooling Equipment
- ☑ Cooling Tower Management
- ☑ Commercial Kitchen Equipment
- ☐ Laboratory/Medical Equipment
- ☐ Other Water Use
- ☐ Alternate Water Sources

Information and Education Programs

AWBERC promotes environmental awareness of sustainability and water conservation though the implementation of the EMS for EPA Cincinnati. Signage is posted in Annex 2 to make employees aware of water conservation efforts used to achieve the LEED-NC Gold certification. BMP status has been achieved in this area.

Distribution System Audits, Leak Detection and Repair

Water meters are installed to monitor city water supply, cooling tower make-up water, boiler make-up water, and the emergency generator. Under this plan, facility staff will continue to monitor meter readings monthly to track patterns and identify and correct any system malfunctions if they occur.

Water supply piping within the facility is exposed and accessible. Staff are trained to report leaks and malfunctioning water using equipment to a facility maintenance trouble desk or hotline. Reported problems are assigned a service order or work order, which is completed by the facility operation and maintenance (O&M) contractor. BMP status has been achieved in this area.

Water Efficient Landscaping

AWBERC is located on a park-like setting in the City of Cincinnati. The area surrounding the facility structures is primary covered with turf grass, interspersed with trees and shrubs. Trees were planted bordering the perimeter of the facility for security purposes. Since 2006, the facility has made an effort to plant native plants and trees. Turf grass is allowed to go dormant during

dry summer months, and natural precipitation is used for watering throughout the year. Supplemental irrigation is not required. BMP status has been achieved in this area.

Water-Efficient Irrigation

The facility does not have a permanent, in-ground irrigation system. AWBERC relies on natural precipitation for landscape management because staff determined it was the most environmentally sound approach, and they wanted to set an example for the community. Turf grass is allowed to go dormant during dry summer months. Growth returns with cooler, wetter weather. Planters surrounding the facility entrance are watered with hand-held watering devices. Newly planted trees are watered with soaker bags directly on tree roots. BMP status has been achieved in this area.

Toilets and Urinals

Toilets and urinals throughout the main building are primarily those installed during original construction in the mid 1970's. As such, they are the older, higher-flow design, with flow rates estimated to be approximately 4.5 gallons per flush (gpf). As part of the facility's IRP, sanitary fixtures will be upgraded to high-efficiency designs. Toilets will be replaced with models that offer dual-flush handles, allowing users to select a full flush of 1.6 gpf for solid waste or 1.1 gpf for liquid waste. Urinals will be replaced with 0.125 gpf models. Restroom upgrades are being implemented on a floor-by-floor basis. The sixth floor restroom renovations will be completed in fall 2009. Fifth floor restrooms renovations will immediately follow. Upgrades to the restrooms on the other floors of the main building are planned.

Some restrooms in the main building were retrofitted after the early 1990's and are, therefore, compliant with the Energy Policy Act of 1992 (EPAct 1992) water efficiency requirements. Restrooms installed in the pathology containment area, women's locker room, and the American with Disabilities Act-compliant restrooms on the ground floor are equipped with 1.6 gpf toilets and 1.0 gpf urinals.

Restrooms in Annex 1 and Annex 2 are equipped with dual-flush toilets.

The three restrooms in the CDC are equipped with seven toilets of older, higher-flow design.

A complete inventory of sanitary fixtures is provided in Table 5.

Table 5. AWBERC and CDC Inventory of Sanitary Fixtures

Fixture Type	Flow Rate	Total Number
Toilets	4.5 gpf	68
	1.6 gpf	8
	Dual flush: 1.6/1.1 gpf	13
Urinals	4.5 gpf	22
	1.0 gpf	1
Lavatory faucets	0.5 gpm	73
Showerheads	2.5 gpm	10

Janitorial staff and employees are trained to report leaks or other maintenance problems, which are assigned a service order or work order and are corrected by the O&M contractor. BMP status can be achieved in this area by completing the planned restroom upgrades to high-efficiency fixtures.

Faucets and Showerheads

High-efficiency, maximum 0.5 gallons per minute (gpm) faucets and maximum 2.5 gpm showerheads are used throughout the facility. System pressure is maintained between 20 to 80 pounds per square inch.

Janitorial staff and employees are trained to report leaks or other maintenance problems, which are assigned a service order or work order and are corrected by the O&M contractor. BMP status has been achieved in this area.

Boiler/Steam Systems

Two main steam boilers (45,000 pounds per hour (lbs/hr) each) and one summer boiler (8,700 lbs/hr) are used to generate steam for building heating hot water and domestic hot water. The boiler water system is monitored and maintained every two weeks under a service contract to prevent system scale and corrosion and to optimize condensate reuse. Boiler water quality parameters such as sulfite, hardness, conductivity, alkalinity, pH, and iron are monitored and controlled though periodic testing and chemical treatment provided by a service contractor. System components are visually inspected and water chemistry is read several times each day by the boiler operator. Approximately 80 to 85 percent of steam condensate is sent to a condensate receiver and pumped to a surge tank. Make-up water is softened and then blended with the recovered condensate. The blended water is returned to the boiler system.

Boiler blowdown is sent to a flash tank prior to discharge to the sewer. Tempering water is introduced into the flash tank to cool the discharge. The tempering water is controlled with a temperature sensor, which should sense when hot discharge is passing to the drain and turn on the tempering water as needed. Under this plan, routine inspection and maintenance of the temperature-activated tempering water flow will be implemented to ensure that the tempering water only flows when the blowdown is occurring. BMP status will be achieved once these procedures are in place.

Single-Pass Cooling Equipment

Since 1990, AWBERC has made a concentrated effort to significantly reduce the use of potable water for single-pass cooling. Prior to that date, single-pass water was used for condenser cooling water on auxiliary cooling units on environmental chambers, freezers, the computer room, and laboratory spaces throughout the facility with concentrated heat loads. A 100-ton rooftop cooling tower was installed in 1990, and a second, 150-ton rooftop cooling tower was installed in 1998 to provide year-round recirculated cooled water (one of which was removed from service in June 2009 and the process water loops were combined). The availability of recirculated cooled water has allowed the facility to eliminate most applications of single-pass cooling, thereby reducing total facility water consumption by over 80 percent.

Single-pass cooling was also eliminated on the air compressors in the basement mechanical room, as the air compressors were replaced with air cooled units.

Single-pass cooling is still present on the kitchen ice maker and the cold water booster pump used to maintain pressure on the domestic cold water supply system.

Laboratory wastewater that has the potential to be biologically active is collected and treated in a 500-gallon kill tank prior to discharge. The temperature in the kill tank is raised to 270°F to treat the wastewater. After treatment, the tank contents are cooled to 160°F with single-pass cooling water prior to discharge.

To achieve BMP status in this area, the remaining uses of single-pass cooling water should be eliminated.

Cooling Tower Management

The AWBERC facility is equipped with two cooling towers, a main 5,000-ton unit which provides condenser water cooling for the building chillers, and one rooftop unit (150 tons) which provides recirculating condensing water for the computer room, environmental chambers and approximately 45 packaged air conditioning units located throughout the building. A third cooling tower, a 100-ton rooftop unit, was removed from service in June 2009. The main cooling tower is taken out of service during the winter when the chillers are not operating. The remaining rooftop unit is operated year round. The cooling towers are maintained and operated with water conservation as a priority.

The water treatment on the main cooling tower was converted from a traditional chemical treatment regime to magnetic treatment for the 2003 cooling season. The magnetic process was designed to change the surface charge on suspended particles and allow them to coagulate and be removed in a cyclone separator. The magnetic process on this cooling tower was causing corrosion, biological growth issues, excessive blowdown requirements, and a decrease in cycles of concentration on the main cooling tower loop. Therefore, AWBERC adopted a traditional chemical treatment regime after the 2008 cooling season. A cooling tower system quality and performance review is conducted every two weeks by service contractor. A conductivity meter is used to automatically control cooling tower blowdown at approximately 1,600 microsiemens per centimeter (*u*s/cm). This conductivity control range provides for approximately four cycles of concentration.

Cooling tower water chemistry on the rooftop unit is monitored monthly by the O&M contractor and the blowdown frequency is manually adjusted based on those results. The conductivity target is 1,500 to 1,800 *u*s/cm. This conductivity target provides for approximately four to five cycles of concentration and efficient cooling tower water use. As the IRP is implemented, the process cooling load on the rooftop cooling towers will be reduced. One rooftop unit has been removed from service, and the process water loops of the two units have been combined. At completion of the IRP, the remaining rooftop unit will be removed from service.

BMP status has been achieved in this area.

Commercial Kitchen Equipment

A full service cafeteria in the main building serves approximately 450 meals per day. Tableware is washed in a tunnel washer. Prior to placing dishes in the tunnel washer, they are rinsed with a pre-rinse spray valve that complies with the Environmental Policy Act of 2005 (EPAct 2005), flowing at 1.6 gpm or less. Pots and other large items are washed in three large pot washing sinks. The kitchen is also equipped with a food preparation sink and two dishwashing sinks. An ENERGY STAR steam cooker is also used for food preparation.

The CDC is equipped with a kitchen used to prepare snacks. Water-using equipment includes an automatic ENERGY STAR dishwasher and pot washing sinks. Faucets are equipped with 0.5 gpm faucet aerators.

BMP status has been achieved in this area.

Laboratory/Medical Equipment

Purified water for laboratory use is generated by reverse osmosis (RO). The RO reject water is discharged to the drain. The RO system is equipped with instantaneous flow meters. The system run time is recorded periodically by the system operator.

Central vacuum is supplied by a liquid-ring vacuum pump located in the basement mechanical room. Under this plan, the vacuum pump will be replaced with a dry system.

AWBERC is equipped with a rack, bottle, and tunnel washer used to clean vivarium equipment. The bottle and rack washers operate in batch mode and have a wash cycle, rinse cycle, and final rinse cycle. They are set up to reuse final rinse water as wash water for the next batch, saving approximately 38,000 gallons of water annually.

Approximately four to five gallons per minute of city water is conditioned and used as water supply an aquatic culture system. The water flow rate to each tank is calibrated monthly and controlled to minimize water use, while maintaining the required level of water exchanges per hour and dissolved oxygen in each tank. Careful flow control to minimize water use is considered a BMP in this area.

AWBERC is equipped with 10 steam sterilizers, listed in Table 6. Several of the older units have a continuous flow of tempering water to drain, estimated to be 0.5 gpm each, at all times.

Retrofit kits are available to eliminate this flow except for times when condensate is being discharged above 140°F. Use of these retrofit kits is considered a best practice and will be implemented under this plan. The other steam sterilizers are more modern units with integral control of tempering water so it is only used when needed.

Water is used as necessary in individual laboratories for bench scale experimentation and glassware preparation.

Table 6. AWBERC Steam Sterilizers

Location	Model	Continuous Tempering Water Flow?
Third Floor, Equipment Bay 1	Amsco 3041	No – Manual supply valve closed (could be retrofit)
Third Floor, Equipment Bay 7	Amsco 3021	Yes
Third Floor, Equipment Bay 8	Amsco 3021	Yes
Third Floor, Equipment Bay 9	Steris/Amsco Century SV-120	No – Only when needed
Third Floor, Equipment Bay 10	Amsco Stage 2	Yes
Seventh Floor Prep Room	Amsco Eagle SV-3043	Yes
Seventh Floor Prep Room	Amsco 3021	Yes
Seventh Floor Biosuite	Steris	No – Only when needed
Seventh Floor Biosuite	Steris	No – Only when needed
Seventh Floor Biosuite	Steris	No – Only when needed

BMP status can be achieved in this area by converted the vacuum pump to a dry system and installing retrofit kits on five steam sterilizers to eliminate the continuous flow of tempering water.

Other Water Use

The CDC has one clothes washer used to clean approximately five loads of laundry a day, five days per week. The washer is a Whirlpool WTW5540SQ0 model and is not highly efficient or ENERGY STAR-labeled. It uses approximately 40 gallons of water per load. BMP status could be achieved in this area by replacing the clothes washer with a high-efficiency, ENERGY STAR-labeled clothes washer that uses approximately 20 to 25 gallons of water per load.

Alternative Water Sources

Air handler condensate could be collected from air handling units in the AWBERC basement mechanical room and used as cooling tower make-up water. This source of alternative water will be evaluated for feasibility and cost-effectiveness under this plan.

BMP status can be achieved in this area by evaluating the use of air handler condensate as cooling tower make-up water, and implementing it if it is cost effective.

7.0 DROUGHT CONTINGENCY PLAN

The City of Cincinnati does not have a water management plan specifically for droughts. However, as conditions warrant, AWBERC is prepared to follow the water use recommendations and restrictions outlined under the State of Ohio Drought Response Plan, issue on January 1994. Key recommendations of this plan are summarized below. Ohio has defined four levels of drought response: normal phase, alert phase, conservation phase, and emergency phase.

Normal Phase

In this phase, water supplies are adequate and climatological conditions are normal. Recommended action is to develop water conservation measures and a water recycling program. Appropriate conservation and recycling measures at AWBERC are addressed by this plan.

Alert Phase

Climatological data indicates above-normal temperatures and below-normal precipitation for an extended period. Streamflow, reservoir levels, and/or groundwater levels are below normal over an extended period of time. Recommended action is to activate conservation measures and reduce water for nonessential uses, such as fountains, landscape watering, and washing of motor vehicles.

Conservation Phase

Climatological conditions worsen and water levels continue to decline. Water conservation measures are increased and all nonessential uses are eliminated.

AWBERC strives to operate at a level consistent with the conservation phase as part of its routine operating practice. Water is not used for nonessential purposes such as landscape irrigation, decorative fountains, and motor vehicle washing.

Emergency Phase

Climatological conditions continue to worsen and water levels continue to diminish. Conservation measures have to be more stringent to ensure adequate water supply for health and sanitary purposes. Recommended action is to reduce operational levels so that a water use reduction goal of 30 percent can be achieved.

If a conservation phase drought is declared in the greater Cincinnati water management district, the Director of the Facilities Management and Services Division will convene a meeting with the Director of each Office of Research and Development (ORD) research laboratory operating at AWBERC to identify modifications to facility operations that could be implemented to achieve emergency phase reductions. Operational changes will be implemented as necessary to meet declared emergency phase water use restrictions.

Additional information on the Ohio Drought Response Plan can be found at:

<http://www.epa.state.oh.us/ddagw/Documents/droughtactions.pdf>
<http://drought.unl.edu/plan/state%20plans/Ohio.pdf>

8.0 COMPREHENSIVE PLANNING

The Director of the Facilities Management and Services Division will ensure that water supply, wastewater generation, and water efficiency BMPs are taken into account during the initial stages of planning and design for any facility renovations or new construction. This will be accomplished by including water efficiency as a design objective in purchase orders issued to the project Architectural/Engineering firm. These factors will also be considered prior to the purchase and installation of any equipment that would measurably change facility water consumption. To achieve this objective, the Project Officer for the facility O&M contract will consider the impact on facility water use when reviewing and approving work orders for installation of new equipment. Where available, WaterSense labeled products (www.epa.gov/watersense) will be purchased or specified.

9.0 STATUS UNDER GUIDING PRINCIPLES FOR HIGH PERFORMANCE AND SUSTAINABLE BUILDINGS

The Interagency Sustainability Working Group (ISWG), formed as a subcommittee of the EO 13423 Steering Committee, has established guiding principles to assist agencies in meeting the high performance and sustainable buildings goals of EO 13423, section 2(f). In the December 1, 2008 Guiding Principles for Sustainable Existing Buildings, ISWG established six supporting principles for protecting and conserving water. The status of the AWBERC and CDC facilities with respect to the supporting principles for protecting and conserving water at existing buildings is documented in Table 7.

Table 7. Status of Guiding Principle to Protect and Conserve Water

Topic	Status
Indoor Water	Option 1: Comparison to 2006 Plumbing Codes *AWBERC's Main Building and Annex 1:* Because of its use of older, higher-flow sanitary fixtures, AWBERC's main building and Annex 1's combined potable water use is 62 percent greater than the calculated water use baseline. The baseline is established as 160 percent of Uniform Plumbing Code 2006 under the Guiding Principles for Sustainable Existing Buildings, Indoor Water Option 1. As of FY 2009, AWBERC restrooms are under renovations and all will be retrofit with high-efficiency sanitary fixtures. *CDC:* Because of its use of older, higher-flow sanitary fixtures, CDC's potable water use is 27 percent greater than the calculated water use baseline. The baseline is established as 160 percent of Uniform Plumbing Code 2006 under the Guiding Principles for Sustainable Existing Buildings, Indoor Water Option 1. *Annex 2:* Use of dual-flush toilets and 0.5 gpm lavatory flow controllers enables Annex 2 to achieve a 25 percent reduction compared to its calculated water use baseline. The baseline is established as 120 percent of Uniform Plumbing Code 2006 under the Guiding Principles for Sustainable Existing Buildings, Indoor Water Option 1. Option 2: Comparison to FY 2003 or year thereafter: *AWBERC and Annex 1:* Draft water use intensity data show an increase of 44%[3] between FY 2003 and FY 2008. Water use intensity was 51.67 gallons/gsf in FY 2003 and 74.44 gallons/gsf in FY 2008. *CDC:* Draft water use intensity data show a decrease of 4.5% between FY 2003 and FY 2008. Total water use intensity was 35.10 gallons/gsf in FY 2003 and 33.51 gallons/gsf in FY 2008. *Annex 2:* The facility was occupied during FY 2007. As such, two complete years of water consumption data have not yet been collected, so water use comparisons cannot be made.
Outdoor Water	The facility does not have an in-ground or permanent irrigation system. Selective hand watering is used when new plantings are installed, or during extended periods of no rain. A recent effort to install native species has further decreased watering needs. Grass is not watered and is allowed to brown during dry periods.
Water Metering	The incoming city water supply is metered. Flow totalizing meters are also installed on many of the major subsystem flows.
Stormwater Management	An existing stormwater pond is maintained as a dry detention facility near the CDC. A low impact development (LID) courtyard installed as part of the Annex 2 construction includes porous pavers and native landscaping. Annex 2 has a green roof which reduces stormwater runoff. A study is planned to evaluate green infrastructure stormwater management retrofits.
Process Water	Potable water is not used to improve the facility's energy efficiency at the expense of water efficiency.

[3] This is a draft estimate. The water use intensity comparison from FY 2003 to FY 2008 is being evaluated by EPA's contractor, Eastern Research Group, Inc., to assure accounting of accurate facility gross square footage.

Table 7. Status of Guiding Principle to Protect and Conserve Water

Topic	Status
Water-Efficient Products	Standard SOW language used for renovation projects includes high-efficiency water fixture requirements. Though most of the facility's sanitary fixtures are older, high flow models, restroom renovations currently underway include dual-flush toilets (1.6 gpf and 1.0 gpf flushing options) and high-efficiency urinals (0.125 gpf). These renovations are planned throughout the facility. Toilets in Annex 2 are dual-flush models. Faucets and showerheads throughout the facility are high-efficiency models. A clothes washer used at CDC is not a high-efficiency model. Purchase of WaterSense-labeled products, where available, is included as part of this plan.

10.0 OPPORTUNITIES FOR FURTHER WATER CONSERVATION

AWBERC is pursuing the following projects to achieve additional reductions in water use:

1) Install Water Conservation Kit for Steam Sterilizer Trap Cooling. Five steam sterilizers discharge a constant steam of cooling water to drain. These sterilizers will be retrofit with kits that significantly reduce the use of this tempering water by controlling the application of tempering water to only those times when condensate is being discharged to drain at above 140°F. This modification is estimated to save approximately 1,200,000 gallons and $9,200 per year. The payback period for this retrofit is estimated to be approximately one to two years.

2) Capture and Reuse Air Handler Condensate. AWBERC will evaluate capturing air handler condensate and routing it to the cooling tower as part of air handler upgrades under the IRP. Initial engineering evaluation indicates that it may be possible to capture up to 1,400,000 gallons per year. This water will significantly offset the consumption of potable water for cooling tower make-up, and result in savings of approximately $11,000 per year.

3) Replace Toilets and Urinals with High-Efficiency Models. AWBERC will replace originally-installed toilets and urinals with high-efficiency models (dual-flush toilets (1.6 gpf and 1.1 gpf flushing options) and 0.125 gpf urinals) as part of the restroom renovation project underway and will evaluate replacing toilets at CDC. Including toilets at CDC, up to 68 toilets and 22 urinals could be upgraded. At an installed cost of $1,000 per fixture, simple payback on each fixture upgraded is approximately 4 to 6 years at current water and sewer rates. Total annual savings are projected to be 2,300,000 gallons and $17,500.

4) Control Flash Tank Tempering Water Flow in Boiler Room. During a water use assessment in April 2009, the flash tank tempering water temperature sensor appeared to be malfunctioning. Tempering water was flowing continuously at approximately 3 gpm even when there was no cooling demand. Adjustment or repair of the tempering flow control so tempering water only flows when needed could save approximately 750,000 gallons of water and $5,800 annually.

5) Replace Vacuum Pump with Dry System. AWBERC will replace the liquid-ring vacuum pump with a dry system. The project has been funded and is projected to save 200,000 gallons and $2,000 each year.

6) Replace Clothes Washer at CDC with High-Efficiency, ENERGY STAR-labeled Clothes Washer. The existing clothes washer at the CDC could be replaced with an ENERGY STAR-qualified model, which would reduce wash water use by half. Total annual savings are projected to be 25,000 gallons and $200, offering a payback period of approximately five years.

7) Eliminate Single-Pass Cooling. Single-pass cooling is currently applied to the ice maker in the kitchen and the cold water booster pump in the basement mechanical room. In each case, it should be determined if it is cost effective to replace the equipment with air-cooled models. Potential savings from eliminating single-pass cooling on the kitchen ice maker is estimated to be 300,000 gallons and $2,300 per year. Potential savings from eliminating single-pass cooling on the cold water booster pump is 300,000 gallons and $2,300 per year.

Appendix A

WATER BALANCE SUPPORTING CALCULATIONS

Table A-1. Water Balance Supporting Calculations – FY 2008, Andrew W. Breidenbach Environmental Research Center, Cincinnati, Ohio

Major Process	Annual Consumption (gallons)	Supporting Calculations and Source Documentation
Main building and Annex 1 sanitary	3,750,000	Estimate based on 600 people × 25 gallons/person/day × 250 days/year = 3,750,000; 600 people in main building and Annex 1 estimated by AWBERC staff; 25 gallons/person/day assumed with use of old, higher flow sanitary fixtures
Annex 2 sanitary	209,679	Metered total (assumed all water use from sanitary)
Cafeteria operation	230,000	Estimated based on 2 gallons/meal × 450 meals/day × 250 days/year = 225,000; 2 gallons/meal estimated based on FEMP federal water use indices for short order restaurant of 3 to 8 gallons per customer (including bathroom facility) (http://www1.eere.energy.gov/femp/water/water_useindices.html), because bathroom facilities were accounted for elsewhere in our estimate, used lower end of 2 gallons/meal; 450 meals/day estimated by AWBERC cafeteria staff
Cooling tower (main)	5,053,200	Metered total
Cooling tower (roof #1)	675,738	Metered total
Cooling tower (roof #2)	353,941	Metered total for March 2008 - October 2008 and December 2008 and other month projections using 2006/2007 metered data
Boiler make-up	2,418,287	Metered total
Air compressor cooling	0	Eliminated
Vacuum pump seal water	208,000	Metered total (2004)
Domestic cold water booster pump cooling	300,000	Estimate based on 0.5 gallons/min × 60 minutes/hour × 24 hours/day × 365 days/year = 262,800; 0.5 gallons/minute estimated by visual observation of flow during assessment; flow is continuous
Kitchen ice maker cooling	300,000	Estimate based on 0.6 gallons/minute × 60 minutes/hour × 24 hours/day × 365 days/year = 315,360; 0.6 gallons/minute estimated by visual observation of flow during assessment; flow is continuous
Emergency generator cooling	27,087	Metered total for February 2008 - December 2008 and one month projected
Aquatic culture water	2,938,983	Metered total for December 2007 - December 2008
Animal operations: bottle washer	19,000	Estimate based on 360 gallons/week × 52 weeks/year = 18,720; 360 gallons/week estimated from AWBERC scientists

Table A-1. Water Balance Supporting Calculations – FY 2008, Andrew W. Breidenbach Environmental Research Center, Cincinnati, Ohio

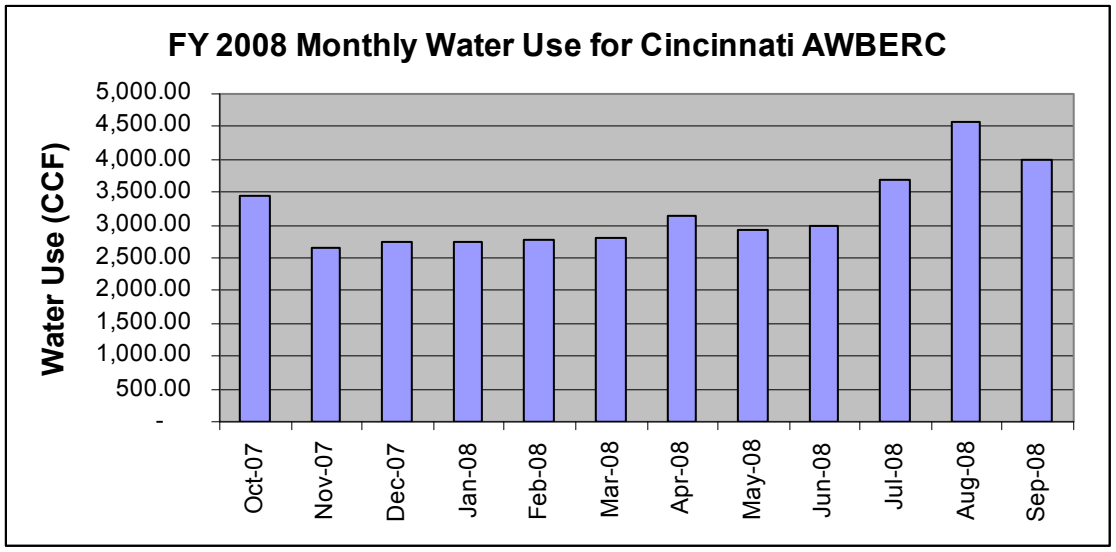
Major Process	Annual Consumption (gallons)	Supporting Calculations and Source Documentation
Animal operations: tunnel washer	5,000	Estimate based on 100 gallons/week × 52 weeks/year = 5,200; 100 gallons/week estimated from AWBERC scientists
Animal operations: rack washer	57,000	Estimate based on 1100 gallons/week × 52 weeks/year = 57,200; 1100 gallons/week estimated from AWBERC scientists
Animal operations: room wash down	20,000	Estimated based on 2 gallons/minute × 60 minutes/hour × 1 hour/day × 130 days/year = 15,600; 2 gallons/minute, 1 hour/day, and 130 day/years based on discussion with vivarium supervisor during site assessment in 2004
Steam sterilizers	1,300,000	Estimate based on 5 steam sterilizers × 0.5 gallons/minute × 60 minutes/hour × 24 hours/day × 365 days/year = 1,314,000; 0.5 gallons/minute estimated by visual observation of flow during assessment; flow is continuous
RO reject water	53,000	Estimate based on 2.48 gallons/minute × 60 minutes/hour × 357 hours/year = 53,122; 521 hours/year and 3.2 gallons/minute data collected from instantaneous meter and data logs on site in 2007, and 16 hours/month and 1.75 gallons/minute data collected from instantaneous meter and data logs on site in 2009, the two data points were averaged for this estimate
Flash tank in boiler room	1,500,000	Estimate based on 3 gallons/minute × 60 minutes/hour × 24 hours/day × 365 days/year = 1,576,800; 3 gallons/minute based on visual estimate
Kill tank in boiler room	120,000	Estimate based on 10 gallons/minute × 60 minutes/hour × 1.5 hours/run × 2.5 runs/week × 52 weeks/year = 117,000; 10 gallons/minute, 1.5 hours/run, 2.5 runs/week based on discussion with AWBERC mechanic
Miscellaneous laboratory and other uses	9,472,225	Engineering estimate, by difference: total metered water use minus all other calculated water uses
Total	**29,011,140**	**Based on metered potable water use in FY 2008**

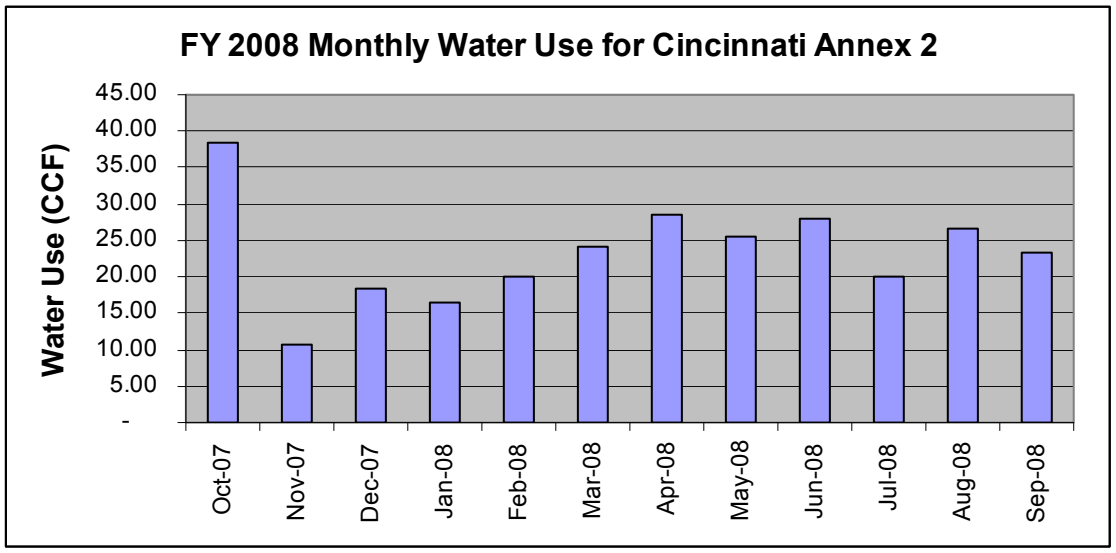
Table A-2. Water Balance Supporting Calculations – FY 2008, Child Development Center, Cincinnati, Ohio

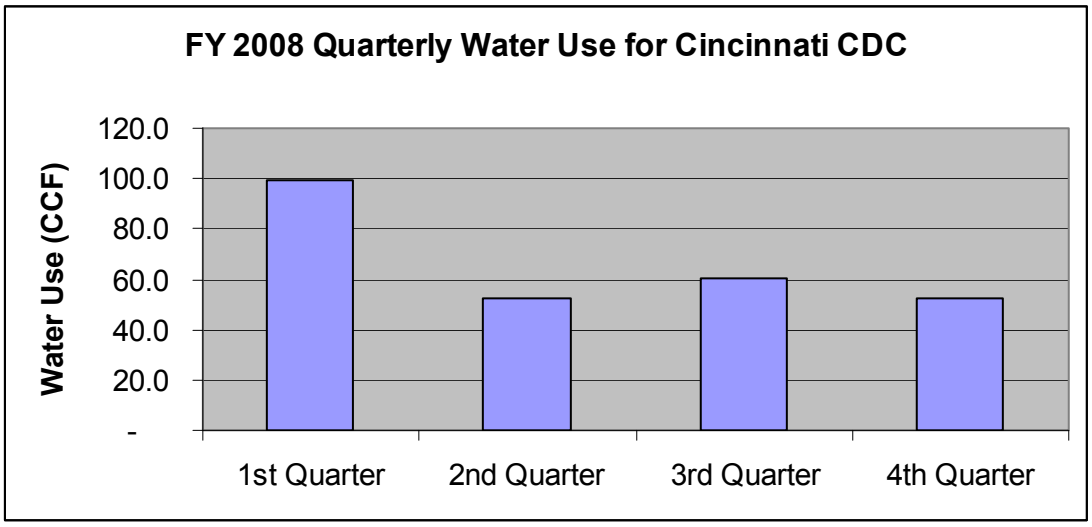
Major Process	Annual Consumption (gallons)	Supporting Calculations
Sanitary	146,860	Engineering estimate, by difference: 197,860 – 50,000 – 1,000 = 146,860.
Clothes washer	50,000	Estimated based on 40 gallons/load × 5 load/day × 250 days/year = 50,000; 40 gallons/load estimated from specific model used, 5 loads/day estimated by CDC staff member
ENERGY STAR dishwasher	1,000	Estimated based on 4 gallons/cycle × 1 cycle/day × 250 days/year; 4 gallons/cycle estimated from ENERGY STAR, 1 cycle/day assumed
Total	**197,860**	**Based on metered potable water use in FY 2008**

Appendix B

FY 2008 WATER USE CHARTS


FY 2008 Monthly Water Use for Cincinnati AWBERC
Water Use (CCF)
5,000.00
4,500.00
4,000.00
3,500.00
3,000.00
2,500.00
2,000.00
1,500.00
1,000.00
500.00
-
Oct-07
Nov-07
Dec-07
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Sep-08


FY 2008 Monthly Water Use for Cincinnati Annex 2
Water Use (CCF)
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
-
Oct-07
Nov-07
Dec-07
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Sep-08


FY 2008 Quarterly Water Use for Cincinnati CDC
Water Use (CCF)
120.0
100.0
80.0
60.0
40.0
20.0
-
1st Quarter
2nd Quarter
3rd Quarter
4th Quarter