

**CLEANING, FLUSHING, & WATER TREATMENT PROCEDURE
FOR BUILDING HYDRONIC SYSTEMS****1.01 GENERAL**

- A. The following Guideline assumes the chemicals for the CFW Procedure (Cleaning, Flushing, and Water Treatment) are provided by the Water Treatment Supplier (WTS) working directly for the University:
1. This Guideline is intended to provide the Project A/E (Architect/Engineer) with general procedural information that is intended to benefit the efficiency and longevity of the University's building closed loop hydronic systems (e.g. heating hot water; chilled water). It is the responsibility of the A/E to adjust the Guideline specifics to meet the needs of the particular Project system. A CFW Procedure should be developed by the A/E and included in the Project Manual for all projects that modify existing or install new Building Hydronic Systems.
 2. The implementation of this CFW Procedure is the responsibility of the Prime Contractor defined by the A/E in the Project Manual.
 3. For standalone building recirculating hydronic systems, recommend to OSU Project Manager whether CFW Procedure should be applied to both new and existing piping or to new piping only. Thoroughly clean and passivate hydronic systems prior to operation of the building systems. For chilled water systems that will be connected to a Campus Central Chiller Plant, all new and existing piping shall be thoroughly cleaned and passivated prior to operation of the building systems and/or circulation to any of the Campus Central Chilled Water Plants (McCracken, East Regional, and South Campus Chiller Plants).
 4. The A/E shall provide the OSU WTS and the Contractor with a calculated water volume (gallons) of the hydronic system(s) for the CFW Procedure and the required flow rate (GPM) to remove debris, slag and/or surface corrosion byproducts.
 5. The Water Treatment Supplier shall submit to the OSU Project Manager, the SDS (Safety Data Sheets) documentation for all chemicals used for the CFW process.
 6. The A/E shall provide a piping system drawing or sketch to identify the hydronic piping system scope of work that will be flushed and cleaned, including bypass or isolation valves to protect equipment that may be damaged during the CWF process. The A/E's drawings shall identify the connections to feed the chemicals and the makeup water as well as the location of the sanitary floor drains to bleed and flush the wastewater used to clean and passivate the pipes. The makeup water source(s) and bleed locations selected shall provide adequate capacity to drain and flush the

system within a 4-hour period (or as directed by the OSU Project Manager). If the existing pipe and valve taps are inadequate, provide new valve connections.

7. The Contractor shall prepare a plan to implement the CFW Procedure and provide a detailed sketch based on the A/E's drawing, showing bypasses, valves, blank-offs, blind flanges, etc., as necessary to accomplish the work. The Contractor shall provide documentation and acceptance of the CFW procedure to the OSU Project Manager. See Exhibit C.

B. Prerequisites for the Process of Cleaning & Flushing:

1. The Contractor shall inform the OSU Office of Environment Health & Safety (EHS) prior to the planned cleaning and flushing process. EHS will serve as the initial and primary contact with the city of Columbus Division of Sewerage and Drainage (DOSD). The required Standard Operating Procedure (SOP) and Pre-Approval documents are attached to this Guideline as Exhibit A and Exhibit B.
2. The chemicals used by the Contractor need to be in compliance with the City of Columbus; the WTS shall furnish this information to the Contractor and the OSU EHS for their use and disposition.

C. Preparation for Cleaning:

1. Contractor shall install a BYPASS pipe wherever needed between the hydronic return & supply lines to recirculate the entire system using the hydronic pumps installed. The diameter of this pipe shall be at least 1/3 of the diameter of the main hydronic lines. The contractor shall also remove or cap the temporary BYPAS to a permanent configuration (to allow future CFW) when flushing is complete and approved water chemistry is achieved.
2. Contractor shall remove all strainer screens prior to flushing all systems, including mud from the dirt legs. Contractor shall clean and replace/reinstall all strainer screens after the final cleaning and flushing procedure has passed the final test criteria noted herein.
3. Complete circulation must be achieved during the cleaning procedure. The A/E shall develop a CFW PLAN to achieve a minimum velocity of three feet per second (3 ft/s) in the pipes to ensure the cleaning chemicals will work properly. If necessary, isolate parts of the piping system to attain at least (3 ft/s) in piping being flushed. All electric, pneumatic, and thermostatic operated valves shall be full open. All deadend runs shall be looped together with piping not less than one-third the size of the run.

D. Cleaning Chemical (PreKleen-1301 or approved equivalent):

1. The cleaning solution shall be formulated to remove light grease, cutting oils, loose mill scale, organics, and extraneous construction debris. The

cleaner shall contain a polyphosphate, an anionic polymer dispersant, and a low-foaming surfactant. Formulations shall not contain any ingredient that may be harmful to system materials of construction and shall be acceptable to the City of Columbus for discharge to the city sanitary sewer system. Sufficient cleaner shall be used to effectively clean and condition all piping so as to promote the formation of a uniform passivating film on all metal surfaces.

E. Pre-Operational Cleaning Procedure:

1. Prior to adding PreKleen-1301, the WTS shall run a conductivity test on a sample of system water. The WTS shall record this reading.
2. Add (PreKleen-1301) directly into the system via a bypass chemical feeder or chemical transfer pump at a dosage rate of 1-2 gallons per 1,000 gallons system volume.
3. After system water has been circulated, WTS shall run a conductivity test on a sample of system water to confirm sufficient cleaner has been added. The conductivity should be 500-1000 mmhos/cm greater than the conductivity reading obtained prior to adding PreKleen-1301. If cleaner concentration is insufficient, add more PreKleen-1301 until concentration is sufficient.
4. After Pre-Kleen 1301 concentration is sufficient, circulate the system water for 48 hours minimum [120 hours maximum].
5. After obtaining permission from OSU EHS, drain the system completely, paying particular attention to mud from drop legs and all low points. If draining quickly is not possible, slowly bleed the system to drain until all the cleaning solution has been removed.
6. Refill the system with clean potable water.
7. Recirculate for 8-12 hours and then completely drain the system again.
8. The WTS shall sample the water and run a conductivity test to determine if the cleaner has been flushed out of the system. The conductivity of the sample should be approximately the same as city water conductivity indicating the cleaner has been removed from the system. If necessary, bleed the system to drain until the conductivity approximates the city water conductivity.
9. Test Criteria Requirements - WTS shall sample the water to determine the following:
 - a. TDS levels should be less than 3500

- b. pH level should be between 9 to 11

 - c. ATP should be <75. Determine bacteria activity by running ATP tests. If ATP (Alive) value exceeds 75, biocide should be added to kill bacteria. Micro Control 15N, or approved equivalent, at a dosage of (1) pint per 1,000 gallons volume should be added and circulated for 24 hours. Resample and run ATP tests again to confirm bacteria kill.

 - d. Iron levels should be <1.0 ppm, If the iron concentration is >1.0 ppm, Contractor shall continue flushing the system with clean potable water until it is <1.0 ppm.
10. After WTS confirms that the system meet the required test criteria, Contractor shall reinstall all strainers and add the corrosion inhibitor: (5) gallons of CorrPro-1380, or approved equivalent, per 1,000 gallons system volume to develop 500-1000 ppm nitrite as NO₂. The length of time between the completion of the cleaning procedure and the addition of the corrosion inhibitor shall not exceed (24) hours.

Exhibit A

The Ohio State University *Slug Discharges Standard Operating Procedure*

Janice Fry

Date of Revision: 18 November 2014

The Ohio State University
Office of Environmental Health & Safety
1314 Kinnear Road
Columbus, OH 43212
Phone: [\(614\) 292-1284](tel:6142921284)
Fax: [\(614\) 292-6404](tel:6142926404)

1.02 DISCHARGES

A. Introduction:

This document outlines the steps to take for slug discharges to the sanitary sewer. A slug discharge is any non-routine discharge to the sanitary sewer, whether the discharge is planned or an accidental release, at a flow rate or concentration that could cause a violation of prohibited discharge standards. The most common types of planned slug discharges are from cleaning and flushing of water lines, tanks, or boilers.

B. Planned Discharges:

1. Planned slug discharges to the sanitary sewer require pre-approval from the City of Columbus Division of Sewerage and Drainage (DOSD) Pretreatment Office. EHS will serve as the primary contact with the DOSD.

C. The project manager or supervisor of any project that proposes discharging water to the sanitary sewer shall contact the Environmental Safety and Health (EHS) Environmental Affairs Office as soon as possible in advance of the planned discharge. The primary EHS contacts for discharges to the sanitary sewer are:

Janice Fry	(614) 292-3223
Kent Halloran	(614) 292-5529
Tom Novotny	(614) 688-1764

D. The following information is needed prior to notifying DOSD:

1. Proposed date(s) of discharge,
2. Proposed total volume and rate of discharge,
3. Material Safety Data Sheets (MSDS) or Safety Data Sheets (SDS) of all chemicals known to be in the discharge,
4. Estimated concentrations of the chemicals in the discharge, and
5. Any other available information regarding the expected nature of the discharge, such as pH, dissolved solids, metals, temperature, etc.

See Attachment 1 for a form to record all the necessary information needed for DOSD approval. The form should be completed and returned to EHS.

The DOSD may require that the discharge be analyzed for specific pollutants of concern prior to granting approval. These specific pollutants and concentrations limits not to be exceeded are listed in Table 1.

Table 1. City of Columbus Division of Sewerage and Drains Discharge Limits

Pollutant	Discharge Limit (ug/L)
Arsenic	1,000
Beryllium	Non detect
Cadmium	500
Chromium	20,000
Chromium, hexavalent	No limit
Copper	2,700
Cyanide	5,000
Hydrocarbon fats, oil, and grease (FOG)	200,000
Phenol	No limit
Bis(2ethylhexyl)Phthalate	No limit
Lead	4,000
Mercury	20
Molybdenum	No limit
Nickel	5,000
Selenium	10,000
Silver	3,000
Zinc	5,500

The DOSD will consider other known pollutants in the planned discharge on a case by case basis.

Once the DOSD has approved the discharge, the discharge must not occur before, during, or immediately after a significant rain or snow melt event. The DOSD should be consulted regarding the timing of the discharge if wet weather or snow melt is a factor.

E. Instructions for Obtaining DOSD Approval of Planned Discharges:

1. The primary DOSD contact for approval of planned discharges is Jim Carpenter at (614) 645-1942.
2. If no one is available at that number, the secondary contact number for DOSD is (614) 645-5876. If no one is available at either number, leave a brief message.
3. If an immediate response is required, contact the Jackson Pike Wastewater Treatment Plant Supervisor's office at (614) 645-3138 (extension-2) to obtain permission prior to discharge.

4. Record the name of the wastewater treatment plant supervisor that granted permission for the discharge.
5. Immediate email follow-up to joc@columbus.gov and pretreatment@columbus.gov is also required. Include information regarding the nature and volume of the discharge, the date and time of discharge, and the name of the wastewater treatment plant supervisor that granted permission to discharge.
6. Attach files of the applicable MSDSs or SDSs to the email.
7. A cc: of this email should be addressed to:

Janice Fry	fry.71@osu.edu
Kent Halloran	halloran.21@osu.edu
Tom Novotny	novotny.66@osu.edu

F. Pre-Approved Routine Discharges:

1. The McCracken Power Plant's routine discharges (boiler blowdown, spent brine from water polishers and softeners, etc.) are allowed under the McCracken Power Plant's Slug Control Plan as approved by the DOSD.

G. Prohibited Discharges:

1. Prohibited Sanitary Sewer Discharges:

Section 1145.20 of the City of Columbus municipal Code of Ordinances prohibits specific types of discharges to the sanitary sewer, including, but not limited to:

- a. Solid or viscous substances, including oils of any kind
- b. Flammable or explosive substances
- c. Any discharge that will cause the sewage temperature in the public sewer to be above one hundred twenty (120) degrees Fahrenheit (forty-nine (49) degrees C) after mixing with other flow in the public sewer at the nearest accessible point downstream from the user, or above one hundred four (104) degrees Fahrenheit (forty (40) degrees C) at the influent to the POTW treatment facility, or above one hundred sixty (160) degrees Fahrenheit (seventy-one (71) degrees C) in the user's sewer at the nearest accessible point upstream from confluence with the public sewer system.
- d. Corrosive substances
- e. Any discharge with a pH below 5.0 S.U. or above 12.5 S.U.
- f. Oxygen-demanding pollutants (biochemical oxygen demand (BOD), etc.)
- g. Toxic or poisonous substances
- h. Radioactive wastes
- i. Wastes regulated under the Resource Conservation and Recovery Act (RCRA)

2. Prohibited Storm Sewer Discharges:

- a. Planned discharges to the storm sewer are not allowed under any circumstances.
Contact EHS immediately if an accidental release to the storm sewer has occurred. The primary EHS contacts for accidental discharges to the storm sewer are:

Kent Halloran	(614) 292-5529
Tom Novotny	(614) 688-1764
EHS 24-hr Emergency Response	(614) 292-1284 (option#1, then select option#2)

3. Unplanned Discharges:

- a. Immediate notification to the DOSD is required if an unplanned slug discharge has occurred.
- b. An EHS representative will immediately notify the Pretreatment Section of the City of Columbus DOSD at 645-5876 of any unplanned non-routine discharge to the sanitary sewer system.
- c. This is required to enable the wastewater treatment plant to take appropriate countermeasures to minimize potential risk to the wastewater treatment workers, damage to the wastewater treatment system, and/or the receiving waters.
- d. In the event of an unplanned slug discharge, all appropriate MSDSs or SDSs will be consulted to provide the wastewater treatment plant with timely information.
- e. If no one is available at DOSD to accept the telephone notification, the EHS representative will call the DOSD Sewer Maintenance Section at (614) 645-7102, which is answered 24 hours / day.

4. A follow up report must be written and submitted to the Pretreatment Department by EHS within five (5) calendar days of the incident. The report shall contain the following:

- a. A description of the discharge
- b. The cause of the discharge
- c. The exact dates and times of the discharge, and if the discharge continues, the time by which the discharge is expected to be corrected.
- d. Any and all steps taken, or to be taken, to reduce, eliminate, and prevent recurrence.

5. See Attachment 2 for a template of a follow up notification letter to DOSD.

The written report shall be sent to:

City of Columbus
Division of Sewerage and Drainage
Pretreatment Section
1250 Fairwood Avenue
Columbus, Ohio 43206-3372

Pre-Approval Information for Slug Discharge to Sanitary Sewer

The City of Columbus Division of Sewerage and Drainage (DOSD) requires pre-approval of non-routine slug discharges to the sanitary sewer. To expedite the approval process, the project manager should complete this form with all the required information and return to EHS along with Material Safety Data Sheets (MSDS) or Safety Data Sheets (SDS) of any chemicals known to be in the discharge. EHS will notify the project manager when the DOSD approves the discharge. No discharges may occur prior to DOSD approval. Actual approved discharge may be subject to delay in the event of significant rain or snow melt events.

Description of process necessitating discharge to sanitary: _____

Project Manager name/contact information: _____

Location of proposed discharge: _____

Proposed date(s) and time of discharge: _____

Proposed total volume of discharge: _____

Anticipated rate of discharge: _____

Estimated concentrations of any chemicals in the discharge: _____

Any other available information regarding the expected nature of the discharge, such as pH, dissolved solids, metals, temperature, etc.

Return the completed form to either:

Janice Fry
fry.71@osu.edu
138 McCracken Power Plant
2003 Millikin Rd
Columbus, OH 43210
614-292-3223

Kent Halloran
halloran.21@osu.edu
1314 Kinnear Rd
Room 106
Columbus, OH 43212
614-292-5529

{Date}

Mr. Jeff Bertacchi
Pretreatment Program Manager
Division of Sewerage and Drainage
1250 Fairwood Avenue
Columbus, OH 43206-3372

Dear Mr. Bertacchi,

This letter serves as a written follow up to a telephone notification made to {insert name of DOSD employee who took the telephone report} of the Division of Sewerage and Drains on {insert date of telephone notification} regarding an unplanned slug discharge from The Ohio State University to the sanitary sewer.

The unplanned discharge occurred on {insert date}, at approximately {insert time} and consisted of approximately {insert volume} of wastewater from {insert description of process or source of wastewater discharged}, containing {insert any known constituents of concern}.

This discharge was caused by {insert description of cause}. The Ohio State University has implemented the following measures to prevent a recurrence of this discharge: {insert description of corrective action taken}. [Optional text, if applicable: {Attached are MSDSs of the known constituents in the discharge.}]

Please contact me at 614-{insert phone number} or {insert email address} if you require additional information.

Sincerely,
{insert signature}

{insert name}
{insert title}

cc: Tom Novotny
Mike St. Clair

Exhibit B

The Ohio State University

Pre-Approval Information for Slug Discharge to Sanitary Sewer

Janice Fry

Date of Revision: 18 November 2014

The Ohio State University
Office of Environmental Health & Safety
1314 Kinnear Road
Columbus, OH 43212
Phone: (614) 292-1284
Fax: (614) 292-6404
www.ehs.osu.edu

1.03 PRE-APPROVAL // SLUG DISCHARGE

The City of Columbus Division of Sewerage and Drainage (DOSD) requires pre-approval of non-routine slug discharges to the sanitary sewer. To expedite the approval process, complete this form with all the required information and return to EHS along with Material Safety Data Sheets (MSDS) or Safety Data Sheets (SDS) of any chemicals known to be in the discharge. EHS will notify the project manager when the DOSD approves the discharge. No discharges may occur prior to DOSD approval. Actual approved discharge may be subject to delay in the event of significant rain or snow melt events.

Description of process necessitating discharge to sanitary: _____

Project Manager name/contact information: _____

Location of proposed discharge: _____

Proposed date(s) and time of discharge: _____

Proposed total volume of discharge: _____

Anticipated rate of discharge: _____

Estimated concentrations of any chemicals in the discharge: _____

Any other available information regarding the expected nature of the discharge, such as pH, dissolved solids, metals, temperature, etc.

Return the completed form to either:

Janice Fry
fry.71@osu.edu
138 McCracken Power Plant
2003 Millikin Rd
Columbus, OH 43210
614-292-3223

Kent Halloran
halloran.21@osu.edu
1314 Kinnear Rd
Room 106
Columbus, OH 43212
614-292-5529

Exhibit C

The Ohio State University *Hydronic System Cleaning, Flushing Water Treatment*

Janice Fry

Date of Revision: 18 November 2014

The Ohio State University
Office of Environmental Health & Safety
1314 Kinnear Road
Columbus, OH 43212
Phone: (614) 292-1284
Fax: (614) 292-6404
www.ehs.osu.edu

1.04 CLEANING // FLUSHING // WATER TREATMENT - COMPLETION

The Contractor and OSU Project Manager must execute this form at the completion of the CFW (Cleaning/Flushing/Water Treatment) process. The Contractor shall include this Form, and all attachments, in the O&M manual and Systems Manual.

Comments:	
Inspected by: Date	Reviewed and Approved by: Date (With Conditions)
Signatures	
Final Inspection by: Date (Conditional Approval)	Final Review and Approval by: Date
Signatures	