2.0 SYSTEM STARTUP

2.1 System Prestart Checklist

2.1.1 Prerequisites

A. All electrical and mechanical tags/locks are released; and the equipment is in a safe condition to operate.

B. Essential Instrumentation is available per Attachment C.

C. The Electrical Distribution System is in service.

D. All circuit breakers and fuses are intact/closed.

E. The Instrument Air System is in service.

F. The Raw City Water System is in service.

G. The Integrated Controls System (ICS) is energized and in service.

2.1.2 Precautions

The following precautions are system-specific operational considerations that must be closely followed. Failure to follow these precautions may result in personnel injury or equipment damage.

A. All work shall be performed by qualified individuals. A qualified person is one familiar with the construction and operation of the equipment and the hazards involved.

B. Whenever there is work to be performed on or near exposed circuit breaker parts or equipment, there is danger of injury due to electrical shock, unexpected movement of equipment, or other electrical hazards. The circuit breaker parts and equipment that endanger the operator shall be de-energized (stored energy device/springs discharged) and tagged/locked out with the control power fuses pulled in accordance with the Lock and Tagout Procedure.

C. After a circuit is de-energized by a circuit protective device, the circuit shall not be manually reenergized until it has been determined that the equipment can be safely energized. All protective relays are to be reset, but only after the state of the targets is recorded and management approval is received.

D. Never defeat an interlock associated with any circuit breaker.

E. When a circuit breaker has tripped due to a fault, never re-close the circuit breaker until the reason for the fault has been identified and corrected; and, the protective relays have been reset.

F. Exercise caution around rotating machinery. Keep loose clothing, hair and jewelry away from motors, fans, belt drives, pump couplings, etc.

G. Chilled Water equipment operates automatically and can start without warning. To prevent personnel injury, use caution when inspecting rotating equipment in AUTO mode. Isolate the equipment as required in accordance with the Lock and Tagout Procedure.

H. Pumps must not be started with their suction or discharge valves closed. Throttling of the discharge valve is acceptable during the startup of a centrifugal pump.

I. Exercise caution while operating in the vicinity of the Chiller. Ensure that the hazards, precautions, and personal protective equipment requirements of the refrigerant (R-134a) Safety Data Sheet are read, understood, and complied with prior to operating system components or working in the vicinity of the Chillers.

2.1.3 Prestart Checklist

A. Check that the Chilled Water System is ready for service as required and all safety tags/locks are cleared in accordance with the Lock and Tagout Procedure.

B. Verify that all valves are lined up as shown in Attachment A.

C. Verify that all circuit breakers are lined up as shown in Attachment B.

D. Verify that all protective relays are reset.

E. Verify that all system alarms/trips are cleared and reset (except normal shutdown alarms).

F. Verify that all local control panels and the ICS are powered and ready for operation.

G. Verify that all Instrumentation is lined up and ready for normal operations.

2.1.4 System Environmental Issues

Corrosion Control Chemical Safety

For corrosion control, the Chilled Water System has Kroff KR-41L added regularly. This chemical can be dangerous for several different reasons. The following describes precautions associated with KR-41L and its health effects. This Summary DOES NOT take the place of the SDS (Safety Data Sheet), located in the Control Room. Ensure that all required personal protective gear is used when working in the vicinity of the Chemical Feeder, when chemicals are being added.

Description		
Kroff Chemical Company, Inc.'s KR-41L is a corrosive, highly-basic inorganic liquid composed of sodium nitrite (30-40%), sodium tetraborate pentahydrate (<5%), sodium hydroxide (<2%), and a proprietary mix of non-hazardous materials (>55%). It is acutely toxic, highly corrosive to skin and eyes, highly toxic to aquatic wildlife, and a known Class 1B carcinogen and reproductive toxin. The EPA Reportable Quantity for a spill of this material is 250 pounds.		
Location	**Health Hazard**	**First Aid Measures**
Skin	Causes severe skin corrosion and burns.	Immediately remove contaminated clothing and wash affected area with soap and water. Wash contaminated clothing before reuse.
Eyes	Causes serious eye damage.	Immediately flush eyes with water for at least 15 minutes, lifting upper and lower lids to ensure complete rinsing. Remove contact lenses, if present and easy to do, then continue rinsing. DO NOT wait for symptoms to develop – immediately seek medical attention.
Inhalation	Toxic; will burn respiratory tract.	Move victim to fresh air. Seek emergency medical attention of breathing is difficult. Perform artificial respiration is breathing stops.

Description		
Kroff Chemical Company, Inc.'s KR-41L is a corrosive, highly-basic inorganic liquid composed of sodium nitrite (30-40%), sodium tetraborate pentahydrate (<5%), sodium hydroxide (<2%), and a proprietary mix of non-hazardous materials (>55%). It is acutely toxic, highly corrosive to skin and eyes, highly toxic to aquatic wildlife, and a known Class 1B carcinogen and reproductive toxin. The EPA Reportable Quantity for a spill of this material is 250 pounds.		
Location	**Health Hazard**	**First Aid Measures**
Ingestion	Toxic; will burn gastrointestinal tract; can cause cancer if ingested; may damage fertility or unborn children.	DO NOT induce vomiting. Rinse mouth with clean water, immediately seek medical attention. DO NOT give anything by mouth unless instructed by poison center or health care provider.
Note to health care provider: Ingestion of nitrates/nitrites may lead to life-threatening methemoglobinemia.		
Personal Protective Equipment Requirements		
Splash-resistant chemical goggles, chemical-resistant gloves and body-covering clothing; NIOSH-approved respirator if airborne mist/vapor exceeds OSHA airborne limits – TWA of 10 mg/m^3 for sodium tetraborate pentahydrate, and a ceiling level of 2 mg/m^3 for sodium hydroxide.		

2.2 System Startup

2.2.1 Normal System Startup

2.2.1 Normal System Startup			
OPERATOR ACTION		**LOC**	**VERIFICATION**
NOTE: The LOC column in this procedure specifies where the associated ACTION step is performed. A "C" step is performed in the Control Room, an "LP" step is performed at the local panel and an "L" step is performed locally.			
1.	VERIFY that the Chilled Water Supply Return Bypass Valve FV-CHW-03B is in CASCADE or AUTO mode.	C	Valve is in CASCADE or AUTO, ready to automatically respond to CHW System operation.
2.	VERIFY that the Heat Exchanger Bypass Valve FV-CHW-03A is in CASCADE or AUTO mode.	C	Valve is in CASCADE or AUTO, ready to automatically respond to CHW System operation.
3.	For each Chilled Water Pump to be made available, PLACE the H-O-A switch to AUTO.	LP	H-O-A switch is in the AUTO position.
4.	From the Chilled Water Overview Screen, DISPLAY the CHWP Diff Press Control popup.	C	CHWP Diff Press Control popup displays.
5.	From the CHWP Diff Press Control popup, PLACE the control mode to Cascade.	C	Actual control mode displays CAS.
6.	From the Chilled Water Overview Screen, DISPLAY the Chiller CHW Temp SP popup.	C	Chiller CHW Temp SP popup displays.
7.	From the Chiller CHW Temp SP popup, PLACE the control mode to Cascade.	C	Actual control mode displays CAS.

2.2.1 Normal System Startup		
OPERATOR ACTION	**LOC**	**VERIFICATION**
8. From the Chilled Water Overview Screen, for each Chilled Water Pump to be made available, DISPLAY the CHWP Start/Stop Control popup.	C	CHWP Start/Stop Control popup displays.
9. From the CHWP Start/Stop Control popup, PLACE the control mode to Cascade.	C	Actual control mode displays CAS.
10. From the UPMC Heat Exchangers Screen, for each Heat Exchanger to be made available, DISPLAY the HX Secondary CHW Temperature popup.	C	HX Secondary CHW Temperature popup displays.
11. From the HX Secondary CHW Temperature popup, PLACE the control mode to Cascade.	C	Actual control mode displays CAS.
12. DISPLAY the Chilled Water Pump Select popup.	C	Chilled Water Pump Select popup displays.
13. From the Chilled Water Overview Screen, from the Chilled Water Pump Select popup, PLACE the control mode to Cascade.	C	Actual control mode displays CAS.
14. From the Chilled Water Pump Select popup, SELECT RUNTIME **OR** ORDER.	C	1. Selecting RUNTIME will start the next pump with the lowest runtime. 2. Selecting ORDER will start the next pump with the lowest order number.
NOTE: The Chilled Water System is ready for service. It will operate automatically based on flow and differential pressure setpoints to start or stop additional Chilled Water Pumps, Heat Exchangers and Chillers as required		

3.0 SYSTEM NORMAL OPERATION

3.1 Running Checklist

3.1 Running Checklist			
OPERATOR ACTION		**LOC**	**VERIFICATION**
NOTE: The LOC column in this procedure specifies where the associated ACTION step is performed. A "C" step is performed in the Control Room, an “LP" step is performed at the local panel, and an “L" step is performed locally.			
1.	Each shift, CHECK all parameters listed in Attachment C – Essential Equipment and Monitored Parameters.	L, LC, C	N/A
2.	MONITOR Chilled Water Pumps and motors for normal operation, including noise levels, temperature, and vibration.	L	Pump noise/temperature/vibration are normal.
3.	VERIFY that the Chilled Water Pumps’ Variable Frequency Drive Controllers are operating normally.	L	Check at local VFD control panel.
4.	ASSIST the Chemistry Contractor as required to add chemicals to the Chilled Water System.	L	N/A

3.2 Sampling and Analysis of Chilled Water

3.2 Sampling and Analysis of the Water Softening Unit		
OPERATOR ACTION	**LOC**	**VERIFICATION**
NOTE: The LOC column in this procedure specifies where the associated ACTION step is performed. A "C" step is performed in the Control Room, an “LP" step is performed at the local panel, and an “L" step is performed locally.		
1. CLEAN and FLUSH a marked sample tube using sample water from the sample valve on the outlet valve of the vessel to be tested. A minimum of three sample volumes should be flushed.	L	N/A
2. BRIEFLY OPEN the sample valve to obtain a 5 mL sample, THEN CLOSE the sample valve.	L	
3. ADD 4 drops R-0819 Ferroin Indicator to sample, and swirl to mix.	L	Sample should turn red if cooled, orange if room-temperature.
4. ADD R-0820 CAN Solution, counting drops added and swirling to mix after each drop, until color changes to blue.	L	Visual.
5. Multiply drops added by 40 to obtain ppm sodium nitrite.	L	Control range is 400-600 ppm.

3.3 Manually Start an Additional Chilled Water Pump from the ICS

3.3 Manually Start an Additional Chilled Water Pump from the ICS		
OPERATOR ACTION	**LOC**	**VERIFICATION**
NOTE: The LOC column in this procedure specifies where the associated ACTION step is performed. A "C" step is performed in the Control Room, an “LP" step is performed at the local panel, and an “L" step is performed locally.		
1. VERIFY the inlet and outlet isolation valves for the Chilled Water Pump to be started are OPEN.	L	Valves are open.
2. DISPLAY the CHWP Start/Stop popup.	C	CHWP Start/Stop popup displays.
3. From the CHWP Start/Stop popup, PLACE the CHWP Start/Stop control mode to Auto.	C	CHWP Start/Stop control mode changes to AUTO.
4. From the CHWP Start/Stop popup, SELECT START.	C	Pump starts. Pump status changes from STOP/STOPPED to START/RUNNING.
5. Monitor Chilled Water System for proper operation.	C, L	Chilled Water System flow is greater than 900 gpm.
6. IF desired, PLACE Chilled Water Pump just started in CASCADE mode.	C	
NOTE: If the number of Chilled Water Pumps required is less than the number operating, the ICS will stop a running Chilled Water Pump based on flow or differential-pressure setpoints.		

3.4 Manually Stop an Excess Chilled Water Pump From ICS

3.4 Manually Stop an Excess Chilled Water Pump		
OPERATOR ACTION	**LOC**	**VERIFICATION**

3.4 Manually Stop an Excess Chilled Water Pump		
OPERATOR ACTION	**LOC**	**VERIFICATION**
NOTE: The LOC column in this procedure specifies where the associated ACTION step is performed. A "C" step is performed in the Control Room, an “LC" step is performed at the local panel, and an “L" step is performed locally.		
1. DISPLAY the CHWP Start/Stop popup.	C	CHWP Start/Stop popup displays.
2. From the CHWP Start/Stop popup, PLACE the CHWP Start/Stop control mode to Auto.	C	CHWP Start/Stop control mode swaps to AUTO.
3. From the CHWP Start/Stop popup, SELECT STOP.	C	Pump stops. Pump status changes from START/RUNNING to STOP/STOPPED.
4. Monitor Chilled Water System for proper operation.	C, L	N/A
5. VERIFY that Chilled Water Pump CHWP-4 starts to provide CHW flow to plant equipment	C, L	CHWP-4 is running.
6. IF desired, PLACE Chilled Water Pump just stopped in CASCADE mode.	C	