

<b>Location:</b> Akron Water Supply	<b>STANDARD OPERATING PROCEDURE</b>	<b>Creation Date:</b> 11/10/09
<b>Equip ID Numbers:</b> AWS-110-00-PITS	<b>CHEMICAL VAULTS INSPECTION, PUMP OUT, AND ENTRY</b>	<b>Rev Date:</b> 02/28/12; Rev. 3

**TO BE USED BY PROPERLY TRAINED AND AUTHORIZED PERSONNEL ONLY**

This document serves as a guide for the probable hazards of this space and how to remediate those hazards. It is important to remember that each entry is unique and each task performed within the space presents unique hazards. Before entering the space the entry team must insure that they will not create additional hazards by the type of work they are performing or chemicals that they will be using (i.e. welding, painting, cleaning with chemicals, etc.) The tasks and materials that are brought into the space must be carefully evaluated to insure that additional hazards are not created and where necessary additional PPE is selected and proper precautions are taken.

The chemical vaults are Permit-Required Confined Spaces unless the hazards of the space are properly remediated and controlled as detailed within this SOP document.

<p><b><u>CONFINED SPACE HAZARDS</u></b></p> <p><input checked="" type="checkbox"/> Is the space large enough to enter to perform work?</p> <p><input checked="" type="checkbox"/> Is there limited means of egress or entry - Would a person have difficulty getting out of the space in the event of an emergency?</p> <p><input checked="" type="checkbox"/> Is the space NOT designed for continuous human occupancy?</p>	<p><b><u>PERMIT SPACE HAZARDS</u></b></p> <p><input checked="" type="checkbox"/> Contains or has the potential to contain a hazardous atmosphere?</p> <p><input type="checkbox"/> Is there a potential for engulfment of the entrant?</p> <p><input type="checkbox"/> Could an entrant become trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward to a smaller cross section area?</p> <p><input type="checkbox"/> Are there any other serious hazards in space?</p>
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**Purpose:** To document the necessary steps and safe procedures to inspect, pump-out, and repair as needed any leaks from the piping within the chemical vaults at the AWS site in Kent, Ohio.

**Personal Protective Equipment Required:**

**PPE Set 1:** Half face respirator (with MSA chemical cartridge), hard hat, splash proof goggles, chemical resistant clothing including boots and gloves.

**PPE Set 2:** Air monitor, hard hat, safety glasses and work gloves.

**PPE Set 3:** Air monitor, work gloves.

**Air Monitor Type: RKI Eagle**

**Air Monitor Acceptable Reading Levels:** For entry into this space to be permissible the air monitor must provide the following readings for each step an air sampling is required.

- o Oxygen: 19.5 to 23.5%
- o Explosive: 0% of LEL
- o Toxic: 0 PPM
- o ClO2: 0 PPM

**Rescue Team:** Kent Fire Department is the rescue team and requests 24 hour prior notice of entering any permit required confined space if possible. *Dial 330.673.8814 and ask for the officer in charge.*

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## **TASK: Chemical Vault Inspection Procedure**

### **Obtain and wear PPE Set 3**

Pipe lines running within chemical piping vaults contain a variety of water treatment chemicals. Protection from exposure to these chemicals and proper response to minimize release from any leak detected is the focus of this SOP.

**Vault entry is not permitted. Any duty requiring vault entry also requires confined space entry protocol and is not to be undertaken by any individual as part of their inspection rounds.** Access hatches to chemical vaults may be covered in snow and ice that must be cleared prior to opening the hatch. Water may have entered the vault and must be identified as such before pumping to waste.

- 1) Put on work gloves to protect your hands and carry a latch key, flashlight, air monitor and vault inspection log. (appendix C)
- 2) Approach each vault with caution.
- 3) Note any unusual appearance, sound or odor in the area of the vault.
- 4) Insert air monitor hose through the center of the latch key hole and obtain monitor readings. (see figure 1)



Figure 1

Figure 2

- 5) If monitor readings are not normal **STOP**. Notify supervision of the monitor readings. See previous page for acceptable readings.
- 6) If air monitor readings are acceptable, unlatch the hatch using the ¼ inch square stock latch key.
- 7) Position yourself at the hinged side of the vault. Using the hatch door handle, slowly pull the hatch door toward you until it is in the full open and safety latched position. (see figure 3 and 4)

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Figure 3



Figure 4

- 8) Inspect the vault for signs of leakage.
- 9) If the vault is dry, release the hatch door hold open safety and close the vault hatch.
- 10) Note the vault number and condition on the vault inspection report and proceed to the next vault.
- 11) If the vault floor is wet, **without entering the vault**, attempt to determine if there is a chemical leak. Sometimes an improperly sealed hatch lid will allow rain water to collect in the vault. Never assume that liquid present in the vault is water.
- 12) Use the flashlight and inspect each line and connection for drips or leaks.
- 13) If no leaks are found and there is no indication, such as appearance or odor, that the liquid is anything but water, sample the liquid for analysis using the method described in item 6 of the *Chemical Vault Pump Out Procedure*.
- 14) Once a leak is discovered, refer to item 4b of the *Chemical Vault Pump Out Procedure* **Without entering the vault**, attempt to determine which chemical line within the vault is leaking and notify supervision of the leak. At that time a determination will be made as to which plant process changes are required before starting the *Chemical Vault Pump Out Procedure*.

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## **TASK: Chemical Vault Pump Out Procedure**

- 1) Once a chemical leak is discovered notify the Operations Supervisor and they will instruct the Operator to shut off the chemical feed pumps to the respective vault.
- 2) These chemical feed pumps shall be locked and tagged out so they are not accidentally restarted. A lock and tag must be placed by all of the persons performing the pump-out, clean-out, and repair of the space. (Refer to appendix A, Chemical Vault Identification Sheet) to determine exactly which pumps and chemical lines are associated with which vaults)
- 3) Set-up barricades with caution tape strung between, to warn others in the area that work is being performed on this vault. These barricades should be set-up 6' back from vault opening.
- 4) Perform an air monitor reading while vault lid is closed through the key hole. If readings are within acceptable range, then prop open and using the air monitor hose attachment, obtain an air monitor reading about 1 foot inside the space.
  - a) If readings are within the acceptable levels, proceed to next step.
  - b) If readings are NOT within the acceptable levels DO NOT OPEN vault door all the way, wait 30 minutes and perform air monitor testing again. If still not within acceptable levels notify Filter Office Operator and Operations Supervisor of your air monitor readings. **STOP (If unacceptable readings are found a PPE set 1 must be worn before doors are opened.)**
- 5) Obtain and wear **PPE Set 2**, Open vault doors all the way. Personal air monitors must also be worn by persons the entire time they are performing the below tasks. If at any time the air monitor returns results that are not within the acceptable range, work must be stopped.
- 6) Obtain two sampling bottles and sampling stick from laboratory and obtain a sample of the liquid in the vault for the laboratory to analyze for concentration. DO NOT enter the vault to perform this task.
- 7) The contents of the vault shall be pumped out (pump shall be connected using an extension cord with a GFCI, or plugged into a GFCI outlet) into either a clean and sealable container filled no more than 3/4 full or based on the results of the laboratory tests, the liquid may be able to be pumped directly back to a part of the process or onto the ground.
  - a) Entry into space shall not be permitted to perform this task.
  - b) Be certain the hose is thoroughly flushed with water prior to and after use.
  - c) If pumping into containers, be sure that they are properly labeled as to their contents and hazards (based on the results of the laboratory analysis). Be sure to securely place a lid on all containers once completed
- 8) Once the vault is empty of all liquid, use fire hose to rinse vault thoroughly with water for at least 10 minutes. Rinse down side walls of vault as well as all piping and connection points in the vault.
- 9) Pump out the rinsing water of the vault into a storm sewer in the area.
- 10) Proceed to either the **Reclassification to Non-PRCS** or **Permit Entry Procedure** to enter space and perform repair and maintenance as needed.

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## **TASK: Reclassification to Non-PRCS Chemical Vault Entry**

- 1) If entry into the vault is required to repair leak point, be sure that all of the steps listed for the *Chemical Vault Pump Out Procedure* have been properly followed.
- 2) All of the chemical lines shall be flushed with water for at least 30 minutes.
  - a) If Akron Water Supply is unable to flush all of the lines in a chemical vault, this procedure cannot be utilized and a Permit Entry must be performed. **STOP**
- 3) Set-up a powered air ventilation system consisting of hose and air blower to properly ventilate space for 10 minutes, pushing fresh air into the space. Blower should be connected using an extension cord with a GFCI, or plugged into a GFCI outlet. Be sure all persons stay back at least 10' from space during this ventilation process.
- 4) Following a 10 minute ventilation period, use the air sampling hose to take air readings at the top of the vault and every 4' of depth into space. Allow enough time at each point for meter to obtain an effective reading. Insure that readings are within the acceptable levels.
  - a) If air monitoring returns results that are within the acceptable levels, space can be reclassified as a non-permit required confined space.
  - b) If air monitoring returns results that are outside of the acceptable levels for any one of the items listed. Retest space again in 10 minutes, if still not within acceptable levels, **STOP** and go to the Permit Required Confined Space Entry Procedure.
- 5) Once normal air monitor readings have been obtained the vault can be entered. Be sure to obtain and wear all items listed in **PPE Set 2**.
- 6) While inside the Vault continuous personnel air monitoring is required as well as continued powered air ventilation of the space. If at any time the air monitor readings exceed the acceptable levels, all persons must immediately exit the space and space must be reclassified as a Permit Required Confined Space.
- 7) Perform necessary repair and maintenance of lines. Once maintenance is completed notify Operations Supervisor and Filter Operator. Remove Lockout/Tagout devices and have vault chemical lines turned on. Be sure to check for leaks.
- 8) If no leaks close vault lid, remove barricades and other equipment.

*Information was gathered indicating all vaults are capable of having all lines flushed without having to shut down the entire plant except for chemical vault #1. During a time of high water demand a vault may not be able to have all of the lines flushed. In a case where all lines can not be flushed or the plant will not be shut down for vault #1, the entry shall be a permit required confined space procedure. See Standard Operating Procedure for Permit Required Entry for Chemical Vaults.*

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## **TASK: Chemical Vault Entry as a Permit Required Confined Space**

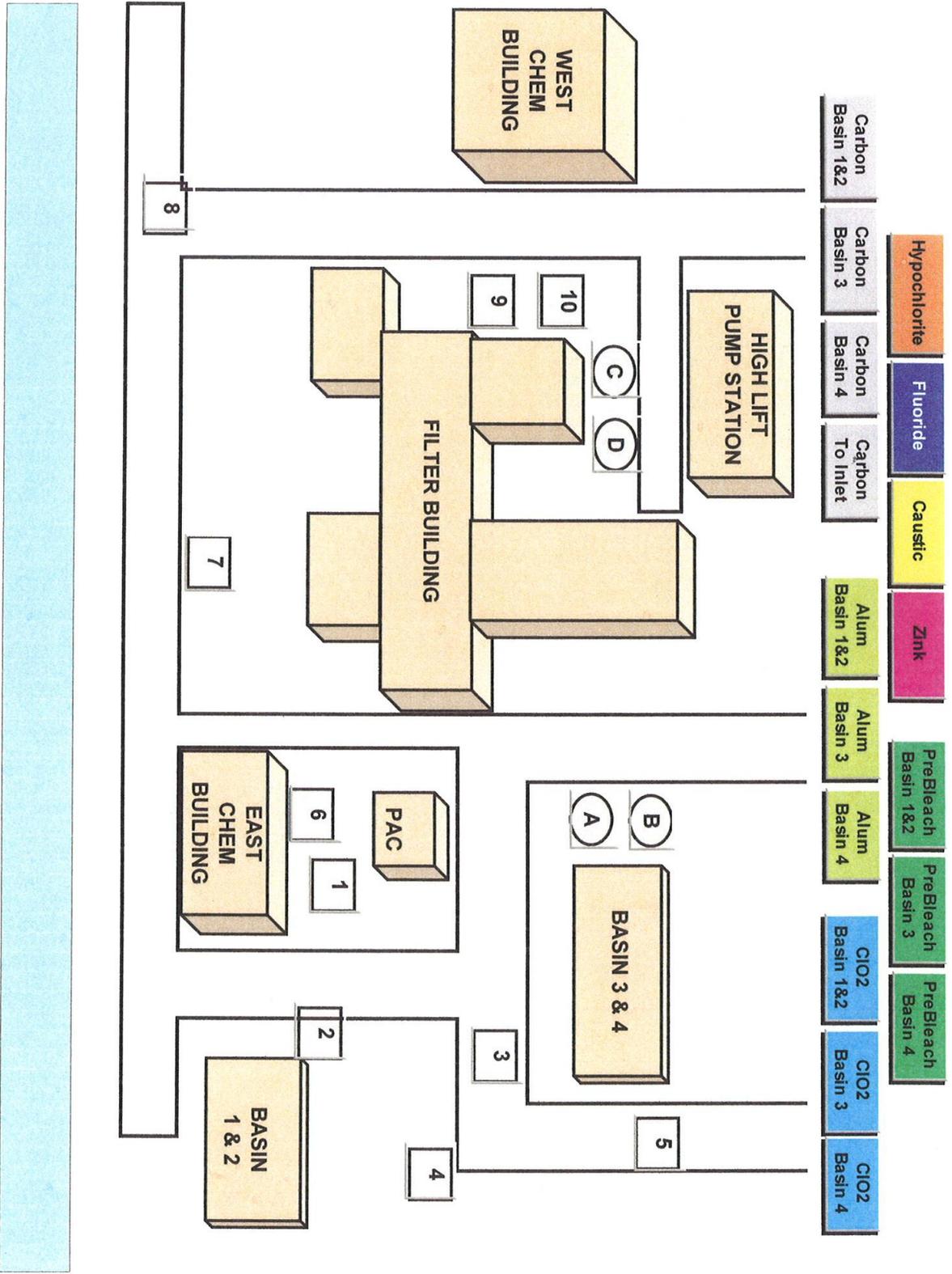
If Akron Water Supply is unable to flush all of the lines in a chemical vault, the following permit required space entry procedure shall be followed.

- 1) Contact Kent Fire Department (Rescue) 24 hours prior to entering the vault.
- 2) Obtain and complete the Confined Space Entry Permit, and post permit at the site.
- 3) If space is filled with liquid, follow the Vault Pump-Out SOP.
- 4) Obtain a working and calibrated air monitor, monitor pump, monitor hose and filter, and obtain and wear **PPE Set 1**. *All persons who will be entering the space or working with the chemicals in the space must wear PPE Set 1.*
- 5) While wearing PPE Set 1, open vault doors all the way and set-up barricades and caution tape around vault opening. These barricades should be set-up 6' back from vault opening to warn others in the area that the vault doors are open.
- 6) Set-up vault ventilation system consisting of hose and air blower to properly ventilate space for 10 minutes, pushing fresh air into the space. Blower should be connected using an extension cord with a GFCI, or plugged into a GFCI outlet. Be sure all persons stay back 10' from space during this ventilation process.
- 7) Perform air monitoring of space. Using the air sampling hose, lower hose into space and take air readings at the top of the vault and every 4' of depth into space. Allow enough time at each point for meter to obtain an effective reading. Insure that readings are within the acceptable levels.
  - a) If air monitoring returns results that are within the acceptable levels, space can be entered, proceed to the next step.
  - b) If air monitoring returns results that are outside of the acceptable levels for any one of the items listed, allow space ventilation to continue and retest space again in 10 minutes.
- 8) Enter the space to perform work. Each authorized entrant shall use a chest or full body harness, with a retrieval line attached at the center of the entrant's back near shoulder level, above the entrant's head, or at another point which presents a profile small enough for the successful removal of the entrant. A mechanical device shall be available to retrieve personnel if the vault is more than 5 feet deep.
- 9) While inside the Vault continuous personnel air monitoring is required. If at any time the air monitor readings exceed the acceptable levels, all persons must immediately exit the space. Perform necessary repair and maintenance of lines. Once maintenance is completed notify Operations Supervisor and Filter Operator. Remove Lockout/Tagout devices and have vault chemical lines turned on. Be sure to check for leaks.
- 10) If no leaks close vault lid, remove barricades and other equipment.

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<b>(HYPOCHLORITE)</b>	WEST CHEM --->VAULT 11---->VAULT 10 ---->VAULT C ---->VAULT D---->PUMP STATION
<b>(FLUORIDE)</b>	WEST CHEM --->VAULT 11---->VAULT 10 ---->VAULT C ---->VAULT D---->PUMP STATION
<b>(ZINK)</b>	WEST CHEM--->VAULT 11 ---->VAULT 10 ---->VAULT C ---->VAULT D---->PUMP STATION
<b>(CAUSTIC)</b>	WEST CHEM --->VAULT 12---->VAULT 9---->VAULT 10 ---->VAULT C ---->VAULT D---->PUMP STATION
<b>(PREBLEACH BASIN 1 OR 2)</b>	WEST CHEM ---->VAULT 10---->VAULT 9 ---->VAULT 8 ---->VAULT 7---->VAULT 1 ---->VAULT 2---->BASIN 1 OR BASIN 2
<b>(PREBLEACH BASIN 3)</b>	WEST CHEM ---->VAULT 10---->VAULT 9 ---->VAULT 8 ---->VAULT 7---->VAULT 6---->VAULT A ---->(BASIN 3 ZONE C) OR (VAULT 1----> BASIN 3 ZONE B) OR (VAULT 1----> BASIN 3 ZONE A)
<b>(PREBLEACH BASIN 4)</b>	WEST CHEM --->VAULT 10---->VAULT 9 ---->VAULT 8 ---->VAULT 7---->VAULT 6 ---->VAULT A ---->VAULT B ----> (BASIN 4 ZONE C) OR (VAULT 1 ----> BASIN 4 ZONE A) OR (VAULT 1----> BASIN 4 ZONE B)
<b>(CIO2 BASIN 1 OR BASIN 2)</b>	WEST CHEM ---->VAULT 10---->VAULT 9 ---->VAULT 8 ---->VAULT 7---->VAULT 1 ---->VAULT 2---->BASIN 1 OR BASIN 2
<b>(CIO2 BASIN 3)</b>	WEST CHEM ---->VAULT 10---->VAULT 9 ---->VAULT 8 ---->VAULT 7---->VAULT 6 ----> (VAULT 1 ---->VAULT 3 ---->BASIN 3 ZONE A) OR (VAULT A ---->BASIN 3 ZONE C)
<b>(CIO2 BASIN 4)</b>	WEST CHEM ---->VAULT 10---->VAULT 9 ---->VAULT 8 ---->VAULT 7---->VAULT 6 ----> (VAULT 3---->VAULT 3---->VAULT 4 ---->VAULT 5---->BASIN 4 ZONE AorB) OR (VAULT A ---->VAULT B---->BASIN 4 ZONE C)
<b>(CARBON BASIN 1 or BASIN 2)</b>	PAC---->VAULT 1---->VAULT 2 ----> (BASIN 1 OR 2)
<b>(CARBON BASIN 3)</b>	PAC-->VAULT 3-->BASIN 3 INFLUENT CHAMBER -->(BASIN 3 ZONE A) OR PAC-->VAULT A ---->(BASIN 3 ZONE C)
<b>(CARBON BASIN 4)</b>	PAC-->VAULT 3-->VAULT 4 ---->VAULT 5---->(BASIN 4 INFLUENT CHAMBER-->BASIN 4 ZONE A) OR PAC-->VAULT A ---->VAULT B---->(BASIN 4 ZONE C)
<b>(CARBON DAM INLET)</b>	PAC-->VAULT 3-->VAULT 4 ---->VAULT 5---->(INLET)
<b>(ALUM BASIN 1 or BASIN 2)</b>	EAST CHEM ---->BASEMENT---->VAULT 1 ---->VAULT 2 ---->BASIN 1 or BASIN 2 FLASH MIXERS
<b>(ACH BASIN 3)</b>	EAST CHEM ---->BASEMENT---->VAULT 1 ---->VAULT 3 ---->BASIN 3 INFLUENT CHAMBER---->BASIN 3 FLASH MIXERS
<b>(ACH BASIN 4 )</b>	EAST CHEM ---->BASEMENT---->VAULT 1 ---->VAULT 3---->VAULT 4---->VAULT 5 ----> BASIN 3 INFLUENT CHAMBER---->BASIN 4 FLASH MIXERS
<b>VAULT A</b>	(CIO2 BASIN 3)-(CIO2 BASIN 4)-(CARBON BASIN 3)-(CARBON BASIN 4)
<b>VAULT B</b>	(CIO2 BASIN 4)-(CARBON BASIN 4)
<b>VAULT C</b>	(HYPOCHLORITE)--(FLUORIDE)--(ZINK)--(CAUSTIC)
<b>VAULT D</b>	(HYPOCHLORITE)--(FLUORIDE)--(ZINK)--(CAUSTIC)
<b>VAULT 1</b>	(ALUM BASIN 1)--(ALUM BASIN 2)--(ACH BASIN 3)--(ACH BASIN 4)--(PREBLEACH BASIN 1)--(PREBLEACH BASIN 2) (PREBLEACH BASIN 3)--(PREBLEACH BASIN 4)--(CIO2 BASIN 1)--(CIO2 BASIN 2)--(CIO2 BASIN 3)--(CIO2 BASIN 4)
<b>VAULT 2</b>	(ALUM BASIN 1)--(ALUM BASIN 2)--(CIO2 BASIN 1)--(CIO2 BASIN 2)--(PREBLEACH BASIN 1)--(PREBLEACH BASIN 2)
<b>VAULT 3</b>	(CIO2 BASIN 3)--(CIO2 BASIN 4)--(CARBON BASIN 3)--(CARBON BASIN 4/CARBON TO INLET)-- (ACH BASIN 3)--(ACH BASIN 4)
<b>VAULT 4</b>	(ACH BASIN 4 )--(CIO2 BASIN 4 )--(CARBON BASIN 4/CARBON TO INLET)
<b>VAULT 5</b>	(ACH BASIN 4)--(CIO2 BASIN 4)--(CARBON BASIN 4)--(CARBON TO INLET)
<b>VAULT 6</b>	(PREBLEACH BASIN 3)--( PREBLEACH BASIN 4)--(CIO2 BASIN 3)--(CIO2 BASIN 4)
<b>VAULT 7</b>	(PREBLEACH BASIN 1)--(PREBLEACH BASIN 2)--(PREBLEACH BASIN 3)--( PREBLEACH BASIN 4) (CIO2 BASIN 1)--(CIO2 BASIN 2)--(CIO2 BASIN 3)--(CIO2 BASIN 4)
<b>VAULT 8</b>	(PREBLEACH BASIN 1)--(PREBLEACH BASIN 2)--(PREBLEACH BASIN 3)--( PREBLEACH BASIN 4) (CIO2 BASIN 1)--(CIO2 BASIN 2)--(CIO2 BASIN 3)--(CIO2 BASIN 4)
<b>VAULT 9</b>	(PREBLEACH BASIN 1)--(PREBLEACH BASIN 2)--(PREBLEACH BASIN 3)--( PREBLEACH BASIN 4) (CIO2 BASIN 1)--(CIO2 BASIN 2)--(CIO2 BASIN 3)--(CIO2 BASIN 4)--(CAUSTIC)
<b>VAULT 10</b>	(PREBLEACH BASIN 1)--(PREBLEACH BASIN 2)--(PREBLEACH BASIN 3)--( PREBLEACH BASIN 4) (CIO2 BASIN 1)--(CIO2 BASIN 2)--(CIO2 BASIN 3)--(CIO2 BASIN 4)--(CAUSTIC)--(FLUORIDE)--(HYPOCHLORITE)--(ZINK)
<b>VAULT 11</b>	(CIO2 BASIN 1)--(CIO2 BASIN 2)--(CIO2 BASIN 3)--(CIO2 BASIN 4) (FLUORIDE NORTH & SOUTH)--(ZINK NORTH & SOUTH)--(HYPOCHLORITE NORTH & SOUTH)
<b>VAULT 12</b>	(CAUSTIC NORTH & SOUTH)
<b>PAC BUILDING</b>	(CARBON BASIN 1,2,3,4 & INTAKE)
<b>BASIN 1 INFLUENT CHAMBER</b>	(ALUM BASIN 1&2)--(PREBLEACH BASIN 1&2)--(CIO2 BASIN 1&2)--(CARBON BASIN 1&2)
<b>BASIN 2 INFLUENT CHAMBER</b>	(ALUM BASIN 2)--(PREBLEACH BASIN 2)--(CIO2 BASIN 2)--(CARBON BASIN 2)
<b>BASIN 3 INFLUENT CHAMBER</b>	(ACH BASIN 3)--(PREBLEACH BASIN 3)--(CIO2 BASIN 3)--(CARBON BASIN 3)
<b>BASIN 4 INFLUENT CHAMBER</b>	(ACH BASIN 4 )--(PREBLEACH BASIN 4)--(CIO2 BASIN 4)--(CARBON BASIN 4)
<b>EAST CHEM BASEMENT</b>	(ALUM BASIN 1,2,3&4)--(CIO2 BASIN 1)--(CIO2 BASIN 2)--(PREBLEACH BASIN 1)--(PREBLEACH BASIN 2)
<b>H.L. PUMP BASEMENT</b>	(HYPOCHLORITE)--(FLUORIDE)--(ZINK)--(CAUSTIC)

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Chemical Vault inspection Log													DO NOT ENTER VAULTS												Report any problems found to Supervision and enter into CMMS. Month/Year _____
Date	Initials	Vault A	Vault B	Vault C	Vault D	Vault 1	Vault 2	Vault 3	Vault 4	Vault 5	Vault 6	Vault 7	Vault 8	Vault 9	Vault 10	Vault 11	Vault 12								
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Comments:

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Approval Date	Reviewed and Approved By:
02/28/2012	George Reed; AWS

Revision Date	Description of Revision
02/28/2012	Inserted new Air Monitor Type and Reworked Vault Schematic