Ventilation Assessment

Water Treatment Facility

Baxter, Minnesota

BAXTE 189660 | June 29, 2026

SEH

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Ventilation Assessment

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SEH No. BAXTE 189660

June 29, 2026

I hereby certify that this report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota

Nick Brula, PE

Date: June 29, 2026 License No.: 46656

Reviewed By: Neil Heinonen Date: June 29, 2026

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Ventilation Assessment

Water Treatment Facility

Prepared for City of Baxter

1 Background

On January 22, 2026, SEH conducted an on-site evaluation of the Baxter Water Treatment Plant (WTP) HVAC and ventilation systems to investigate reported chlorine odors, identify deficiencies contributing to reduced indoor air quality, evaluate potential occupational exposure concerns, and develop recommendations to improve indoor air quality throughout the facility.

The Baxter WTP consists of two occupied levels and a basement pipe gallery. The main level encompasses approximately 11,400 square feet, and the upper level encompasses approximately 10,200 square feet. The east end of the building, which houses the Public Works department, is served by separate HVAC equipment and is operationally independent from the water treatment plant wing.

Based on discussions with plant staff, the facility was originally designed to operate with significantly lower chlorine dosing levels than are currently required for the treatment processes. The present operating conditions utilize chlorine dosing rates that are approximately six times greater than the original design basis. This increase in chlorine usage has resulted in elevated levels of chlorine off-gassing within process areas, contributing to ongoing indoor air quality concerns and persistent chlorine odor throughout the facility. The existing ventilation systems were not designed to accommodate these increased off-gassing conditions, which has contributed to the observed issues with ventilation, air quality, and vapor migration.

This technical memorandum summarizes observations from the site visit, clarifies the distinction between compressed chlorine gas and chlorine off-gassing, reviews applicable exposure criteria, and identifies ventilation deficiencies contributing to current air quality concerns. The findings presented herein will be used to support discussion with the Baxter Utilities Commission.

2 Deficiencies Observed During January 22, 2026 Site Visit

The following deficiencies were identified during the January 22, 2026 site visit and are considered directly relevant to indoor air quality concerns and chlorine vapor migration within the facility:

1. **Room 106 (Dani's Office)**
   Room 106 lacks fresh air ventilation. The occupant reported poor indoor air quality conditions, including illness consistent with inadequate ventilation and contaminant accumulation.

2. **Unsealed Clearwell Access Hatches**
   Clearwell access hatches were observed to be unsealed. Chlorine off-gassing through these openings has been observed, creating a direct pathway for chlorine vapors to enter adjacent interior spaces.
3. **Basement Ventilation Operating Mode and Pressure Control**
   Basement ventilation is configured to operate only during occupancy. In addition, a basement exhaust fan was observed not shutting off, resulting in sustained negative pressure conditions. These conditions can draw contaminated air from clearwell tanks into the building envelope and occupied areas. Plant staff noted that facility air quality is sensitive to exhaust fan operation and pressure relationships.
4. **Chemical Room Ventilation**
   Chemical rooms are not ventilated continuously, which is inconsistent with current mechanical code for ventilation of chemical rooms with chemical storage above the maximum allowable quantity (MAQ).
5. **Pipe Gallery 110**
   Upper Pipe Gallery 110 lacks fresh air ventilation. Staff reported poor air quality, elevated humidity, and significant condensation accumulation on piping and equipment during summer months.
6. **Makeup Air Units MAU-2 and MAU-3**
   MAU-2 and MAU-3 which serve the chemical room and basement, were installed in 2007 and are past their expected service life. Continued performance, reliability, and availability of replacement parts are concerns.
7. **High Service Pump Room HVAC System**
   The High Service Pump Room is served by a fan coil unit, FC-2, that no longer functions properly. FC-2 cooling circuits are no longer functional. The space lacks fresh air ventilation.
8. **Corridor 114**
   Corridor 114 lacks fresh air ventilation.
9. **Aerator Room 201**
   Aerator room lacks fresh air ventilation.

Collectively, these deficiencies indicate that the facility does not have consistent ventilation coverage, effective pressure control, or reliable equipment performance necessary to prevent chlorine vapor accumulation and migration.

3 Distinction Between Compressed Chlorine Gas and Chlorine Off-Gassing

The primary concern expressed by City staff is a noticeable chlorine odor prevalent throughout the water treatment plant process areas. It is essential to distinguish between compressed chlorine gas and chlorine off-gassing, as the hazard profile, regulatory expectations, and appropriate engineering controls differ substantially.

Compressed chlorine gas is not used or stored at the Baxter WTP. No chlorine gas cylinders are utilized in the treatment process. Facilities that store compressed chlorine gas are subject to

additional life-safety requirements due to the potential for catastrophic release; such requirements are not applicable to the Baxter WTP under current operations.

Chlorine off-gassing is the relevant condition at this facility. Off-gassing occurs when dissolved chlorine is released from treated water surfaces (e.g., post-filtration water and clearwells), particularly during draining events or when hatches, lids, or piping are opened. This release is typically low-level and continuous and may accumulate in galleries and lower elevation spaces where air movement is limited.

Chlorine off-gassing is generally managed as an industrial ventilation and exposure control (hygiene) issue, whereas compressed chlorine storage is treated as a life-safety condition requiring specialized safety systems. The prevalent chlorine odor observed throughout the plant suggests inadequate ventilation and airflow to control off-gassed chlorine.

4 Exposure Criteria and Observed Conditions

The Occupational Safety and Health Administration (OSHA) has established a Permissible Exposure Limit (PEL) for chlorine of 0.5 parts per million (ppm) as an 8-hour time-weighted average.

Measured chlorine concentrations at the Baxter WTP have been observed in the parts-per-million range, with values of approximately 0.4 ppm identified in the filter gallery and upper-level spaces. Chlorine odor is generally detectable at concentrations near 0.3 ppm, which corresponds with reported odor conditions throughout the building.

While observed chlorine concentrations are below OSHA's regulatory limit, they are sufficiently close to the odor threshold to result in persistent and noticeable chlorine smell within occupied areas. The combination of measurable chlorine concentrations, persistent odor, and limited air movement indicates that existing ventilation systems are not adequately diluting or removing chlorine vapors under normal operating conditions.

5 Existing HVAC and Ventilation Systems

The water treatment plant is currently served by three makeup air units (MAUs), which provide the primary source of ventilation to process areas and the maintenance garage:

- **MAU-2:** Serves the chemical feed and storage rooms
- **MAU-3:** Serves the basement pipe gallery
- **MAU-4:** Serves the filter gallery

In addition to the makeup air units, various fan coil units, unit heaters, air conditioning units, and exhaust fans located throughout the facility provide climate control and supplemental ventilation. An itemized breakdown of existing HVAC equipment serving the facility is in Appendix A.

6 Code and Safety Considerations

Because compressed chlorine gas is not used or stored at the Baxter Water Treatment Plant (WTP), the facility is not subject to the full range of chlorine gas storage, containment, and emergency response requirements prescribed by mechanical, fire, and building codes. However, applicable codes and standards still require that chemical vapors be adequately controlled

through ventilation to protect personnel, maintain acceptable indoor air quality, and limit corrosion of building systems and equipment.

In Minnesota, there is not a single statute solely governing water treatment plant ventilation. Instead, multiple codes and standards apply, including:

- **2020 Minnesota State Mechanical Code**
- **2022 Recommended Standards for Water Works (Ten States Standards)**
- **Occupational Safety and Health Administration (OSHA) standards and guidelines**
- **ASHRAE Standard 62.1**

These standards collectively establish minimum ventilation requirements, exhaust provisions for chemical spaces where applicable, and general indoor air quality expectations. While minimum code ventilation rates are typically developed for standard commercial occupancies, additional ventilation is often necessary in water treatment facilities and other industrial environments to mitigate contaminants such as chlorine off-gassing and to maintain acceptable working conditions.

6.1 Review of Critical Ventilation Zones

The Minnesota Mechanical Code, Chapter 4 requires that occupied spaces within buildings shall be ventilated by mechanical ventilation or natural means. The Minnesota Mechanical Code, Chapter 5 requires that where hazardous material storage exceeding the maximum allowable quantity per control area occurs, continuous mechanical exhaust ventilation shall be provided. The Fluoride Room currently houses fluoride quantity above the maximum allowable quantity per control area. Code review of the chemical storage room and fluoride room is included in **Appendix C**.

Review of critical zones within the Baxter WTP indicates that the following spaces do not meet the current minimum code-required ventilation rates:

- **Dani's Office 106**
- **High Service Pump Room 109**
- **Pipe Gallery 110**
- **Corridor 114**
- **Aerator Room 201**
- **Chemical Feed Storage 112**
- **Fluoride Room 113**

In addition to the above code deficiencies, several spaces currently meet the minimum code ventilation requirements but require modification of ventilation control strategy and additional ventilation beyond the code minimum to ensure adequate indoor air quality and to mitigate the accumulation and migration of chlorine vapors within the facility. These spaces include:

- **Basement Pipe Gallery 001**
- **Lobby 102**
- **Corridor 107**

For water treatment and process-adjacent spaces, reliance solely on minimum code ventilation rates may be insufficient to address low-level continuous chlorine off-gassing, particularly where

vapor migration pathways, negative pressure conditions, or intermittent ventilation operation exist.

6.2 Recommended Ventilation Basis

To improve indoor air quality and limit the buildup of chlorine vapors, it is recommended that critical zones throughout the plant be ventilated at a minimum rate of approximately 2 air changes per hour (ACH), unless a higher rate is warranted based on space usage, chemical storage, or engineering judgment. This recommended ventilation rate is intended to supplement code minimum requirements and provide improved dilution and removal of off-gassed chlorine under normal operating conditions.

A comprehensive ventilation summary table has been developed and is included in Appendix B. This table documents, for each critical space:

- Applicable codes and standards
- Occupancy classification
- Minimum required ventilation
- Existing ventilation conditions
- Recommended ventilation improvements

7 Conclusions

Based on field observations from the January 22, 2026 site visit, review of existing HVAC systems, and evaluation of applicable codes and standards, chlorine odors and measured concentrations at the Baxter Water Treatment Plant (WTP) are consistent with low-level chlorine off-gassing combined with incomplete ventilation coverage, adverse pressure relationships, and reliability issues associated with aging ventilation equipment.

As documented in *Section 2 – Deficiencies Observed During January 22, 2026 Site Visit*, multiple occupied, process-adjacent, and circulation spaces lack ventilation or proper control of airflow and pressure relationships. Review of these deficiencies against applicable code requirements, indicates that several spaces do not meet current minimum code-required ventilation rates, including **Office 106 (Dani's office), High Service Pump Room 109, Pipe Gallery 110, Aerator Room 201, and Corridor 114**. These conditions represent code deficiencies requiring corrective action.

In addition, several spaces that nominally meet minimum code ventilation requirements were observed to experience poor indoor air quality, chlorine odor persistence, elevated humidity, or vapor migration. These spaces—including **Basement Pipe Gallery 101, Lobby 102, Corridor 107, Chemical Feed Storage 112, and Fluoride Room 113**—demonstrate that code-minimum ventilation alone is insufficient to mitigate low-level continuous chlorine off-gassing under current operating conditions. In these areas, deficiencies are primarily related to ventilation control strategy, operating mode, pressure relationships, and insufficient dilution rather than the complete absence of ventilation.

Unsealed clearwell hatches, intermittent or improperly sequenced ventilation operation, sustained negative pressure conditions, and unventilated galleries provide direct pathways for chlorine vapors to accumulate and migrate into occupied portions of the facility. While measured chlorine concentrations have remained below OSHA's Permissible Exposure Limit, they are consistently

near or above the odor threshold, resulting in persistent chlorine smell and staff concern. These conditions also increase the potential for corrosion of building systems and equipment.

To address these findings, mitigation of chlorine odor and indoor air quality concerns at the Baxter WTP will require a coordinated approach that includes:

- Source control, including sealing identified off-gassing pathways such as clearwell hatches;
- Ventilation coverage, providing fresh air and exhaust to spaces currently lacking code-compliant ventilation;
- Pressure control, avoiding sustained negative pressure conditions that draw chlorine vapors into occupied areas;
- Enhanced dilution, supplementing code-minimum ventilation rates in critical zones to better control low-level continuous off-gassing;
- Equipment reliability, including replacement or rehabilitation of end-of-life ventilation equipment such as FC-2, MAU-2, and MAU-3.

Consistent with the analysis presented in **Section 6**, it is recommended that critical zones throughout the facility be ventilated at a rate of approximately 2 air changes per hour (ACH), unless higher rates are warranted based on space usage, chemical storage, or engineering judgment. A detailed ventilation summary, including code requirements, existing conditions, and recommended improvements for each critical space, is provided in **Appendix B** to support prioritization of corrective actions and review by the Baxter Utilities Commission.

8 Recommendations

Based on the January 22, 2026 site visit, review of existing HVAC systems, and evaluation of indoor air quality conditions and applicable codes, SEH recommends the following actions to mitigate chlorine odors, improve ventilation performance, and address identified deficiencies. These recommendations are intended to be implemented in a coordinated manner and are presented conceptually to support Utilities Commission review. Concept plans for recommended improvements are included in **Appendix D.**

8.1 Replacement of MAU-3

8.1.1 Remove existing MAU-3 and replace with a new Dedicated Outdoor Air System (DOAS).

MAU-3 is past its expected service life and has experienced component failure requiring significant maintenance and repair. It is recommended the unit be replaced with a new dedicated outdoor air system (DOAS). The new DOAS unit to include corrosion-resistant construction and coatings suitable for chlorine exposure, a hot water heating coil, energy recovery wheel, and a DX cooling section. The system shall be configured to provide continuous, neutral ventilation (24 hours per day) to critical zones within the facility. The new unit will include split DX cooling with remote condenser installed on grade on South side of the building. Fence and concrete pad may be extended to accommodate the new condenser.

New ventilation ductwork will be extended to serve both supply and dedicated exhaust for identified critical spaces. Continuous operation is recommended to limit accumulation and migration of chlorine vapors and to maintain stable pressure relationships.

The following continuous ventilation rates are recommended for critical zones served by the new DOAS:

- **Basement Pipe Gallery 001:** 1,000 CFM
- **Corridor 114:** 730 CFM
- **Mechanical Equipment Room 201 (Aerator Room):** 460 CFM

These airflow rates are intended to supplement minimum code requirements and generally align with a target ventilation rate of approximately 2 air changes per hour (ACH) in critical zones, as discussed in Section 6.

Estimated construction cost: $288,000

- Cost includes:
  - Removal of existing MAU-3
  - Furnishing and installation of a new **Dedicated Outdoor Air System (DOAS)** with:
    - Corrosion-resistant construction and coatings
    - Hot water (glycol) heating coil
    - DX cooling section
    - Energy recovery wheel
  - New supply and dedicated exhaust ductwork serving critical zones
  - Controls integration, electrical work, testing, and balancing
- Engineering design, permitting, commissioning, and construction contingencies beyond normal contractor allowances are not included

8.2 Replacement of FC-2

8.2.1 Remove existing FC-2 and replace with a new air handling unit (AHU) capable of heating, cooling, and ventilation.

FC-2, which serves the high service pump room, no longer functions as originally intended. The system no longer provides requisite cooling and heating capacity and is past its expected service life. It is recommended that FC-2 be replaced with a new air handling unit (AHU). The new AHU will include corrosion-resistant construction and coatings suitable for chlorine exposure, a hot water heating coil, and a DX cooling section. The system will provide conditioning and ventilation to the high service pump room and pipe gallery. The new air handler will include split DX cooling with remote condenser installed on the roof.

Dedicated exhaust fans will be installed in the high service pump room and pipe gallery to improve air movement and to mitigate buildup of chlorine vapors.

The following continuous ventilation rates are recommended for critical zones served by the new AHU:

- **High Service Pump Room 109:** 950 CFM
- **Upper Filter / Pipe Gallery 110:** 400 CFM

These airflow rates are intended to supplement minimum code requirements and generally align with a target ventilation rate of approximately 2 air changes per hour (ACH) in critical zones, as discussed in Section 6.

Estimated construction cost: $162,000

- Cost includes:
  - Removal of existing FC-2
  - Furnishing and installation of a new **Air Handling Unit (AHU)** with:
    - Corrosion-resistant construction and coatings
    - Hot water (glycol) heating coil
    - DX cooling section
    - Remote condenser
    - Dedicated exhaust for high service pump room and pipe gallery.
  - New supply and dedicated exhaust ductwork serving critical zones.
  - Controls integration, electrical work, testing, and balancing
- Engineering design, permitting, commissioning, and construction contingencies beyond normal contractor allowances are not included

8.3 Replacement of FCU-1 and SF-1

8.3.1 Remove existing fan coil unit, FCU-1 and supply fan, SF-1 and replace with a new fan coil unit and energy recovery ventilator with increased ventilation capability.

In order to increase ventilation and improve air quality in the public works lobby, corridor, and office, it is recommended that the fan coil unit and supply fan serving these spaces be removed and replaced with a new fan coil capable of heating and cooling and an energy recovery ventilator that will provide increased ventilation to the lobby, corridor, and office. The new air handler will include split DX cooling with remote condenser installed on the roof.

The following continuous ventilation rates are recommended for critical zones served by the new fan coil unit and energy recovery ventilator:

- **Lobby 102:** 200 CFM
- **Office 106:** 35 CFM
- **Corridor 107:** 140 CFM

Estimated construction cost: $83,000

- Cost includes:
  - Removal of existing FCU-1 and SF-1
  - Furnishing and installation of a new **Fan Coil Unit (FCU)** with:
    - Hot water (glycol) heating coil
    - DX cooling section
    - Remote condenser
  - Furnishing and installation of a new **Energy Recovery Ventilator (ERV)** with:
    - Cross flow heat exchanger.
  - New supply, return, and dedicated exhaust ductwork serving critical zones.
  - Controls integration, electrical work, testing, and balancing.

- Engineering design, permitting, commissioning, and construction contingencies beyond normal contractor allowances are not included

8.4 Replacement of MAU-2 and Chemical Wing Ventilation Strategy

8.4.1 Remove the existing MAU-2 and associated exhaust fans and replace with a new two-speed makeup air unit and dedicated exhaust system.

The new MAU-2 system will be designed to operate at variable ventilation rates based on occupancy and operational conditions within the chemical wing.

- During **unoccupied hours**, the system will operate at a reduced ventilation rate of approximately **1 CFM per square foot (1070 CFM)** to maintain baseline air quality and limit vapor buildup. This follows ventilation requirements for chemical storage rooms above the maximum allowable quantity.
- Upon **occupancy or entry**, the system should increase to a higher ventilation rate corresponding to approximately **2,000 CFM** to provide enhanced dilution and removal of chemical vapors.

The new MAU and exhaust fans to be extended and connected to existing ductwork systems serving the chemical wing, with modifications as required to achieve the recommended airflow rates. A new, separate exhaust fan will be installed to serve the fluoride room and ensure no cross contamination of air streams.

Recommended ventilation rates for chemical spaces are as follows:

- **Chemical Feed Storage 112:**
  - 1,010 CFM (unoccupied)
  - 1,600 CFM (occupied)
- **Fluoride Room 113:**
  - 60 CFM (unoccupied)
  - 100 CFM (occupied)

Continuous or near-continuous exhaust in these spaces is recommended to align with mechanical code expectations for chemical storage and to limit migration of chemical and chlorine vapors to adjacent areas.

Estimated construction cost: $131,000

- Cost includes:
  - Removal of existing MAU-2 and associated exhaust fan and Fluoride room exhaust fan.
  - Furnishing and installation of a new two-speed makeup air unit with dedicated exhaust. Separate exhaust fan will be provided for the Fluoride room.
  - Modifications to existing ductwork to serve chemical spaces
  - Controls integration to allow reduced ventilation during unoccupied periods and increased ventilation upon occupancy
  - Electrical work, gas piping, testing, and balancing
- Engineering design, permitting, commissioning, and construction contingencies beyond normal contractor allowances are not included

8.5 Review Operation of MAU-4

8.5.1 Provide further assessment and evaluation of the operation of MAU-4, which serves filter bays.

MAU-4 currently ventilates the upper-level filter bays. The system provides 3500 CFM which equates to approximately 6 ACH. This airflow rate is typical for open cell filter bays. Staff have indicated that high chlorine concentration has been observed at the outlet of MAU-4 and at the discharge section of the unit. The unit provides 100% outside air. Further investigation is required to assess operation and determine corrective actions.

Appendix A

WTP HVAC System Summary

Baxter WTP HVAC System Summary					
Equipment Name	**Quantity**	**Year New**	**Useful Life**	**Type of Equipment**	**Room Name**
Air Exchange Unit for filter Room	1	2022	20	Air Exchange	Aerator Room
Quest Hi-E Dry Humidifier	1	2022	20	Dehumidifier	Aerator Room
Air Exchange Unit (MAU-2)	1	2007	15	Make-Up Air	Aerator Room
Air Exchange Unit (MAU-3)	1	2007	19	Make-Up Air	Aerator Room
Unit Heater	4	2023	15	Unit Heaters	Aerator Room
Quest Hi-E Dry Humidifier	1	2022	8	Dehumidifier	Basement
Heating Unit (FC-2)	1	2007	19	Unit Heaters	Basement
Unit Heater	4	2023	10	Dehumidifier	Basement
Unit Heater	1	2007	10	Dehumidifier	Brine Generator Room
Boiler	2	2007	20	Heating System	Building
Heating System	1	2007	20	Heating System	Building
HI-E Dry Humidifier	1	2023	8	Dehumidifier	Chemical Feed Room
Heater and Thermostat	1	2024	20	Heating System	Chemical Feed Room
Electric Unit Heater	1	2007	10	Unit Heaters	Chemical Feed Room
Exhaust Fan	1	2021	15	Air Exchange	Filter Room
Unit Heater	4	2024	7	Unit Heaters	Filter Room
Fresh Air Intake / Exhaust System	1	2007	15	Make-Up Air	Fluoride
Electric Unit Heater	1	2007	10	Unit Heaters	Fluoride
Quest Hi-E Dry Humidifier	1	2023	8	Dehumidifier	High Service Pump Room
Heating Unit (FC-2)	1	2007	19	Unit Heaters	High Service Pump Room
HI-E Dry Humidifier	1	2007	8	Dehumidifier	Main Hallway
Heating Unit (FC-4)	1	2007	19	Unit Heaters	Main Hallway
Unit Heater	1	2007	10	Unit Heaters	Main Hallway
ACU-3	1	2007	20	Air Conditioning System	MCC Room
Unit Heater	1	2007	10	Unit Heaters	MCC Room
Ceiling Fan	2	2007	10	Ceiling Gans	Pipe Gallery Room
HI-E Dry Humidifier	2	2007	8	Dehumidifier	Pipe Gallery Room
Unit Heater	2	2007	10	Unit Heaters	Pipe Gallery Room

Appendix B

WTP Critical Zone Ventilation Table

Baxter Water Treatment Plant Critical Zone Ventilation Table											
Room No	**Room Name/Type**	**Area (Sq. Ft.)**	**Height (Ft.)**	**Volume (Cu. Ft.)**	**Applicable Code**	**Occupancy Clasification**	**Code Occupany**	**Minimum Code Required Ventilation Rate (CFM)**	**Current Ventilation Rate (CFM)**	**Recommended Ventilation Rate (CFM)**	**Recommended Ventilation Improvements**
001	Basement Pipe Gallery	1973	15.5	30582	ASHRAE 62.1	Occupiable Storage	4	138	3000 (Only When Occupied)	1019	Revise ventilation rate to 1000 CFM of outside air (approxiamtely 2 air changes/hour) Provide continous ventilation (all hours) to mitigate fume buildup.
102	Lobby	550	10.5	5775	Minnesota Mechanical and Fuel Gas Code	Main Entry Lobby	6	61	75	193	Increase ventilation rate to 200 CFM of outside air (approximately 2 air changes/hour) during occuppied hours.
103	Control Room	390	9	3510	Minnesota Mechanical and Fuel Gas Code	Office Space	2	33	50	50	Ventilation system was previoulsy upgraded to included powered ventilation fan and dehumidification. No further changes necessary.
106	Office	127	8.3	1054	Minnesota Mechanical and Fuel Gas Code	Office Space	1	11	0	35	Increase ventilation rate to 35 CFM of outside air (approximately 2 air changes/hour) during occuppied hours.
107	Corridor	390	10.5	4095	Minnesota Mechanical and Fuel Gas Code	Corridor	0	23.4	75	137	Increase ventilation rate to 140 CFM of outside air (approximately 2 air changes per hour) during occuppied hours.
109	High Service Pump Room	1350	21	28350	ASHRAE 62.1	Manufacturing	9	309	0	945	Increase ventilation rate to 950 CFM of outside air (approximately 2 air changes/hour). Provide continous ventilation (all hours) to mitigate fume buildup.
110	Pipe Gallery	770	15.5	11935	ASHRAE 62.1	Manufacturing	5	176	0	398	Increase ventilation rate to 400 CFM of outside air (approximately 2 air changes/hour). Provide continous ventilation (all hours) to mitigate fume buildup.
112	Chemical Feed Storage	1007	16	16112	Minnesota Mechanical and Fuel Gas Code	Storage In Excess of Maximum Allowable Quantity	NA	1007	1900 (Only When Occupied)	1007	Revise ventilation rate to 1010 CFM of outside air 1 CFM per Square Foot. Provide continous ventilation (all hours) to mitigate fume buildup.
113	Fluoride	60	16	960	Minnesota Mechanical and Fuel Gas Code	Storage In Excess of Maximum Allowable Quantity	NA	60	100 (Only When Occupied)	60	Revise ventilation rate to 60 CFM of outside air (1 CFM per square foot) Provide continous ventilation (all hours) to mitigate fume buildup.
114	Corridor	915	24	21960	Minnesota Mechanical and Fuel Gas Code	Corridor	2	64	0	732	Increase ventilation rate to 730 CFM of outside air (approximately 2 air changes/hour). Provide continuous ventilation (all hours) to mitigate fume buidup.
201	Aerator Room	2000	19	38000	ASHRAE 62.1	Manufacturing	14	458	0	460	Increase ventilation rate to 460 CFM of outside air in compliance with code minimum requirments.

Appendix C

Chemical Room Code Review

SECTION 01 41 13

MINNESOTA CODE REVIEW

PART 1 GENERAL

Building: Baxter WTP
Client: City of Baxter, MN
SEH No.: BAXTE 189660
DATE: May 14, 2026

Referenced Codes
2020 Minnesota State Building Code (MNSBC)

- Chapter 1305 - 2018 International Building Code - IBC
- Chapter 1315 - 2020 National Electrical Code - NFPA 70
- Chapter 1323 (Commercial) - 2018 International Energy Conservation Code - IECC
- Chapter 1341 - Accessibility for Buildings and Facilities (Chapter 11 of 2018 IBC & 2009 ICC / A117.1)
- Chapter 1346 - 2012 International Mechanical Code - IMC and 2018 International Fuel's Gas Code - IFGC
- Chapter 4714 - MN Plumbing Code (2012 Uniform Plumbing Code - UPC)
- Chapter 7511 - 2018 International Fire Code

COMMENTARY

This existing water treatment facility was constructed in 2006. The building is a two-story structure with a basement and is classified as Type IIB construction. The primary occupancy of the building is designated as F-2, with accessory occupancies of B for offices and A-3 for the break room. An adjacent garage building is treated as a separate building and is separated by a 3-hour fire wall. The existing chemical room is separated from the remainder of the plant by 1-hour fire barriers and a 1-hour horizontal assembly. The building is not sprinklered. Information regarding the original construction was obtained from project drawings dated January 2006 prepared by Advanced Engineering and Environmental Services, Inc.
This code review focuses primarily on the hazard evaluation of chemicals stored and used in the existing water treatment plant chemical room. The review evaluates the maximum allowable quantities for each chemical in order to determine the applicable occupancy classification and related code requirements for the chemical room only. In addition to chemical hazard classification, this report addresses the applicable occupancy designation, hazardous materials provisions, control area considerations, ventilation, spill control and secondary containment, fire protection features, alarm and detection requirements, and means of egress as they apply to the chemical room evaluation. This is not a comprehensive building code review, but rather a focused analysis of the code requirements associated with chemical storage and use in this area. This code review was completed primarily in accordance with Chapter 1305 of the MNSBC, with related provisions from other adopted codes referenced where applicable.

1.01 IBC CHAPTER 3 - OCCUPANCY TYPE

A. Occupancy Type H-4 – High Hazard (Reference IBC 307.6)
   1. The use of a building or structure, or a portion thereof, that involves the manufacturing, processing, generation, or storage of materials that constitute a physical or health hazard in quantities in excess of those allowed in control areas. (Reference IBC 307.1)
   2. Buildings and structures containing materials that are health hazards. (Reference IBC 307.6)
      a. Hydrofluosilicic Acid (Fluoride)
         1) Maximum allowable quantity per control area
            a) Corrosive (stored and/or in use in a closed loop system) – 500 gal.
            b) Toxic (stored and/or in use in a closed loop system) – 50 gallons

1.02 IBC CHAPTER 4 - SPECIAL PROVISIONS BASED ON USE AND OCCUPANCY

A. Hazardous Materials (IBC Section 414)
   1. Information required. A report shall be submitted to the building official identifying the maximum expected quantities of hazardous materials to be stored, used in a closed system and used in an open system, and subdivided to separately address hazardous material classification categories based on Tables 307.1(1) and 307.1(2). The methods of protection from such hazards, including but not limited to control areas, fire protection systems and Group H occupancies shall be indicated in the report and on the construction documents. The opinion and report shall be prepared by a qualified person, firm or corporation approved by the building official and provided without charge to the enforcing agency. For buildings and structures with an occupancy in Group H, separate floor plans shall be submitted identifying the locations of anticipated contents and processes so as to reflect the nature of each occupied portion of every building and structure. (IBC Section 414.1.3)
      a. Hydrofluosilicic Acid (Fluoride) – Health Hazard (corrosive, toxic)
         1) Quantity stored and/or in use in a closed loop system: 300 gallons
      b. Orthophosphate LPC-4 (non-hazardous)
         1) Quantity stored and/or in use in a closed loop system: 300 gallons
      c. Sodium Hypochlorite (0.8%) (non-hazardous)
         1) Quantity stored and/or in use in a closed loop system: 300 gallons
   2. Design and number of Control Areas (Reference IBC Table 414.2.2)
      a. Not applicable – All hazardous materials addressed in this review are stored in the chemical room. Current quantities of hydrofluosilicic acid in the room exceed the maximum allowable quantities. Accordingly, the chemical room is evaluated as **H-4 occupancy**.
   3. Ventilation (Reference IBC 414.3):
      a. Rooms, areas or spaces of group H in which explosive, corrosive, combustible, flammable or highly toxic dusts, mists, fumes, vapors or gases are or may be emitted due to the processing, use, handling or storage of materials shall be mechanically ventilated as required by the International Fire Code and the International Mechanical Code
         1) IFC and IMC Requirements
            a) Indoor storage areas and storage buildings shall be provided with mechanical exhaust ventilation or natural ventilation can be shown to be acceptable for the materials as stored (Reference IFC 5004.3 and IMC 502.8.1).
               (1) Quantities exceeding the maximum allowable quantity per control area. The storage and use of corrosive materials in amounts exceeding the maximum allowable quantity per control area indicated in Section 5003.1 shall be in accordance with this chapter and Chapter 50. (Reference IFC 5403.2)
   4. Inside storage, dispensing and use (Reference IBC 414.5):
      a. The inside storage, dispensing and use of hazardous materials shall be in accordance with Sections 414.5 and the International Fire Code
         1) Explosion control (Reference IBC 414.5.1)
            a) Explosion control shall be provided in accordance with the International Fire Code as required by Table 414.5.1 where quantities of hazardous materials specified in that table exceed the maximum allowable quantities in Table 307.1(1) or where a structure, room or space is occupied for purposes involving explosion hazards as required by Section 415 or the International Fire Code.
               (1) Not Applicable: Hazards listed in Table 414.5.1 are not present.
            b) IFC Requirement - Explosion control shall be provided in the following locations: Where quantities of hazardous materials specified in Table 911.1 exceed the maximum allowable quantities in Table 5003.1.1(1).
               (1) Not applicable – Hazards listed in Table 911.1 are not present.
         2) Emergency or Standby Power (Reference IBC 414.5.2):
            a) Where required by the International Fire Code or this code, mechanical ventilation, treatment systems, temperature control, alarm, detection or other electrically operated systems shall be provided with emergency or standby power in accordance with Section 2702. For storage and use areas for highly toxic or toxic materials, see Sections 6004.2.2.8 and 6004.3.4.2 of the International Fire Code.

(1) Not applicable when fail/safe system is provided (Reference IBC 414.5.2.2).

b) IFC Requirement - Where mechanical ventilation, treatment systems, temperature control, alarm, detection, or other electrically operated systems are required, such systems shall be provided with an emergency or standby power in accordance with IFC Section 1203 (Reference IFC 5004.7).
   (1) Emergency or standby power is required for toxic or highly toxic liquid hazard areas where IFC Chapter 60 mandates powered ventilation or detection systems, but is not required for corrosive hazardous materials where no such systems are mandated.

c) Where required:
   (1) Exit Signs - Emergency power shall be provided for exit signs as required in Section 1013.6.3. The system shall be capable of powering the required load for a duration of not less than 90 minutes (Reference IBC 2702.2.6).
   (2) Hazardous Materials - Emergency or standby power shall be provided in occupancies with hazardous materials where required by the International Fire Code (Reference IBC 2702.2.10).
      (a) IFC Requirement - Emergency and standby power shall be provided in occupancies with hazardous material as required in the following sections: Section 5004.7 and 5005.1.5.
   (3) Means of Egress Illumination – Emergency power shall be provided for means of egress illumination as required in Section 1008.3. The system shall be capable of powering the required load for a duration of not less than 90 minutes (Reference IBC 2702.2.13).

3) Spill control, drainage and containment. (Reference IBC 414.5.3):

a) Rooms, buildings or areas occupied for the storage of solid and liquid hazardous materials shall be provided with a means to control spillage and to contain or drain off spillage and fire protection water discharged in the storage area where required in the International Fire Code. The methods of spill control shall be in accordance with the International Fire Code (Reference IBC 414.5.3)

b) IFC Requirement – Where required by other provisions of Section 5005, spill control and secondary containment shall be provided for hazardous material liquids in accordance with Section 5004.2.
   (1) Rooms, buildings or areas used for the storage of liquid or solid hazardous materials shall be provided with spill control and secondary containment in accordance with Sections 5004.2.1 through 5004.2.3 (Reference IFC 5004.2).
      (a) Spill Control: Rooms, buildings or areas used for the storage of hazardous material liquids in individual vessels having a capacity of more than 55 gallons (208 L), or in which the aggregate capacity of multiple vessels exceeds 1,000 gallons (3785 L), shall be provided with spill control to prevent the flow of liquids to adjoining areas.
      (b) Secondary Containment: Where required by Table 5004.2.2 buildings, rooms or areas used for the storage of hazardous materials liquids or solids shall be provided with secondary containment in accordance with this section where the capacity of an individual vessel or the aggregate capacity of multiple vessels exceeds both of the following:
         (i) Liquids: Capacity of an individual vessel exceeds 55 gallons (208 L) or the aggregate capacity of multiple vessels exceeds 1,000 gallons (3785 L).
      (c) Required Secondary Containment
         (i) Toxic, Corrosive (liquid only)

B. Group H-4 (Reference IBC Section 415)
   1. Automatic Fire Detection Systems (Reference IBC 415.3)
      a. Group H occupancies shall be provided with an automatic fire detection system in accordance with IBC 907.2.
         1) An automatic smoke detection system shall be installed for highly toxic gases, organic peroxides and oxidizers in accordance with Chapters 60, 62 and 63, respectively, of the International Fire Code.

a) Not Applicable
(1) Hazards are not present
2) IFC Requirements
a) An approved supervised smoke detection system in accordance with Section 907 shall be installed in liquid and solid oxidizer storage areas. Activation of the smoke detection system shall sound a local alarm. (Reference IFC 6304.1.4)
(1) Not Applicable
(a) Hazards are not present

2. Automatic Sprinkler Systems (Reference IBC 415.4)
a. Shall be equipped throughout with an automatic sprinkler system in accordance with IBC 903.2.5.
1) Room is currently not in compliance.
3. Emergency Alarms (Reference IBC 415.5)
a. Emergency alarms for the detection and notification of an emergency condition in Group H occupancies shall be provided.
1) Storage (Reference IBC 415.5.1)
a) An approved manual emergency alarm system shall be provided in buildings, rooms or areas used for storage of hazardous materials. Emergency alarm-initiating devices shall be installed outside of each interior exit or exit access door of storage buildings, rooms or areas. Activation of an emergency alarm-initiating device shall sound a local alarm to alert occupants of an emergency situation involving hazardous materials.
2) Supervision (Reference IBC 415.5.3)
a) Emergency alarm systems shall be supervised by an approved central, proprietary or remote station service or shall initiate an audible and visual signal at a constantly attended on-site location.
3) Emergency Alarm Systems (Reference IBC 415.5.4)
a) Emergency alarm systems shall be provided with emergency power in accordance with IBC 2702.
4. Floors in Storage Rooms (Reference 415.10.3)
a. Floors in storage areas for corrosive liquids and toxic or highly toxic materials shall be of liquid-tight, noncombustible construction.

1.03 IBC CHAPTER 5 - BUILDING AREA

A. Construction Type: II-B, Non-Sprinklered, Mixed-Use Occupancy, Multi-Story building is of non-combustible construction materials (Reference IBC Table 504.3 and 504.4).

B. Occupancy Separation, Separated Occupancies (Reference IBC 508.4)
1. Buildings or portions of buildings that comply with the provisions of this section shall be considered as separated occupancies. (Reference IBC 508.4)
2. Occupancy classification. Separated occupancies shall be individually classified in accordance with Section 302.1. Each separated space shall comply with this code based on the occupancy classification of that portion of the building. (Reference IBC 508.4.1)
3. Separation. Individual occupancies shall be separated from adjacent occupancies in accordance with Table 508.4.
a. Group H-4 / Group F-2 = 3 hour
4. Construction. Required separations shall be fire barriers in accordance with IBC 707 and horizontal assemblies in accordance with IBC 711 (Reference IBC 508.4.4.1)
a. The existing condition provides a 1-hour fire-resistance-rated separation, which does not meet the separation requirements for an H-4 / F-2 separated occupancy configuration under the current code analysis.

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1.04 IBC CHAPTER 9 - FIRE PROTECTION SYSTEMS

A. Automatic Fire Sprinkler Systems (Reference IBC 903)
1. Automatic Fire Sprinkler System requirements:
a. H-4 Occupancy: Required (Reference IBC 903.2.5)
1) The chemical room is out of compliance with the current code

B. Fire Alarm and Detection
   1. H-4 Occupancy: Not Required (Reference IBC 907.2.5)
      a. Automatic smoke detection shall be installed for highly toxic gases, organic peroxides and oxidizers per IFC requirements.
         1) Does not contain hazards listed above

1.05 IBC CHAPTER 10 - MEANS OF EGRESS

A. Egress Distance/Width
   1. Travel Distance (Reference IBC Table 1017.2)
      a. H-4 Occupancy: 175 feet with Automatic Fire Sprinkler System
      b. Travel distance measured from most remote location on a level to exit discharge on grade
   2. Common Path of Egress Travel (Reference IBC Table 1006.2.1)
      a. H-4 Occupancy: 75 feet with Automatic Fire Sprinkler System based on Occupancy.
   3. Egress Width (Reference IBC 1005.3)
      a. Minimum width of egress components shall be determined by multiplying the occupant load by 0.3 for stairs and 0.2 for all other components.

B. Doors
   1. Width: Clear width of egress doors shall be a minimum of 32 inches (Reference IBC 1010.1.1)
   2. Landings: There shall be a floor or landing on each side of a door. Floors shall have a width not less than the width of the door, and a length measured in the direction of travel of not less than 44 inches. Doors in the fully open position shall not reduce the required dimension by more than 7 inches (Reference IBC 1010.1.5)
   3. Panic and Fire Exit Hardware:
      a. Swinging doors serving Group H occupancy (Reference IBC 1010.2.9)

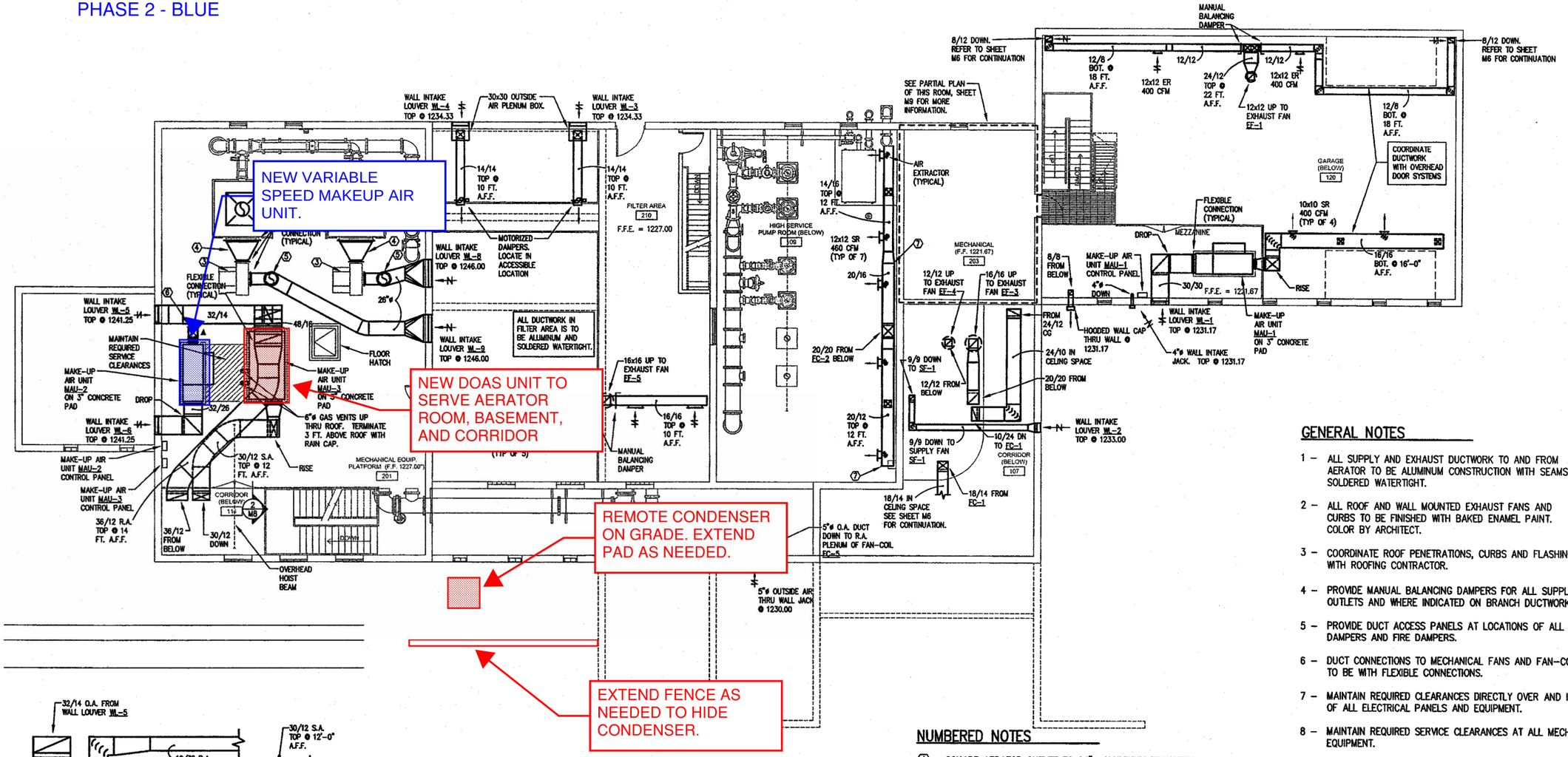
C. Exit Doorways
   1. Minimum quantity of exits per Story.
      a. For each story, two independent exits based on Occupant Load (Reference IBC Table 1006.3.3)
   2. Spaces with one exit (Reference IBC 1006.2.1)
      a. H-4 Occupancies: Rooms with Occupant Load of 10 or less and a maximum common path of egress travel of 75 feet.
         1) Not applicable – Chemical room has 3 exits.

END OF SECTION

Appendix D

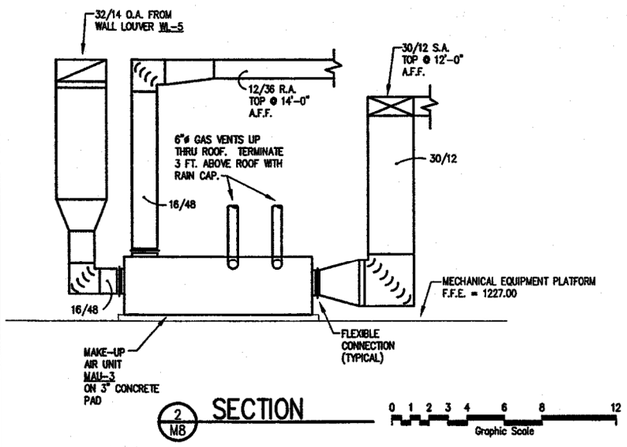
Baxter WTP Concept Plans

PHASE 1 - RED
PHASE 2 - BLUE



SECOND FLOOR DUCTWORK PLAN

Graphic Scale 0 2 4 6 8 12 16 24



2/M8 SECTION

Graphic Scale 0 1 2 3 4 6 8 12

GENERAL NOTES

1 – ALL SUPPLY AND EXHAUST DUCTWORK TO AND FROM AERATOR TO BE ALUMINUM CONSTRUCTION WITH SEAMS SOLDERED WATERTIGHT.

2 – ALL ROOF AND WALL MOUNTED EXHAUST FANS AND CURBS TO BE FINISHED WITH BAKED ENAMEL PAINT. COLOR BY ARCHITECT.

3 – COORDINATE ROOF PENETRATIONS, CURBS AND FLASHING WITH ROOFING CONTRACTOR.

4 – PROVIDE MANUAL BALANCING DAMPERS FOR ALL SUPPLY AIR OUTLETS AND WHERE INDICATED ON BRANCH DUCTWORK.

5 – PROVIDE DUCT ACCESS PANELS AT LOCATIONS OF ALL MOTORIZED DAMPERS AND FIRE DAMPERS.

6 – DUCT CONNECTIONS TO MECHANICAL FANS AND FAN-COIL UNITS TO BE WITH FLEXIBLE CONNECTIONS.

7 – MAINTAIN REQUIRED CLEARANCES DIRECTLY OVER AND IN FRONT OF ALL ELECTRICAL PANELS AND EQUIPMENT.

8 – MAINTAIN REQUIRED SERVICE CLEARANCES AT ALL MECHANICAL EQUIPMENT.

NUMBERED NOTES

① SQUARE AERATOR OUTLET TO 24"ø ALUMINUM TRANSITION. VERIFY EXACT SIZE OF AERATOR OUTLET. ROUTE 24"ø ALUMINUM DUCT UP THRU ROOF. TERMINATE 3 FT. ABOVE ROOF WITH RAIN CAP. PROVIDE PITCHED ROOF CURB AND FLASHING. VERIFY EXACT SIZE AND LOCATION OF DUCT CONNECTION.

② INSULATE ENTIRE RUN OF AERATOR INTAKE AND EXHAUST DUCTS.

③ MOUNT AERATOR FAN ON VIBRATION ISOLATORS. REFER TO SHEETS P15 & P16 FOR ADDITIONAL INFORMATION.

④ TRANSITION AND MAKE CONNECTION TO AERATOR INLET. REFER TO SHEETS P15 & P16 FOR ADDITIONAL INFORMATION.

⑤ 26"ø DUCT TRANSITION TO 21"ø FAN INLET SIZE IN VERTICAL DROP. VERIFY EXACT FAN INLET SIZE. PROVIDE 3/4" THREADED DRAIN OUTLET IN BOTTOM OF DROP.

⑥ 16x16 DOWN WITH FIRE DAMPER "▲" AT FLOOR PENETRATION. PROVIDE ACCESS PANEL AT FIRE DAMPER.

⑦ COORDINATE DUCT MOUNTING WITH PLUMBING AND PIPING ROUTING ALONG WALL. ALLOW ADEQUATE SPACE FOR PLUMBING AND PIPING SYSTEMS.

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AE2S

MUNICIPAL WATER TREATMENT FACILITY RE-BID
CITY OF BAXTER
CITY OF BAXTER, MINNESOTA
SECOND FLOOR DUCTWORK PLAN

DRAWING TYPE	CONSTR.
DRAFTER	SRS
CHECKED / APPROVED	TAW / TAW
DATE	JANUARY, 2006
PROJECT NUMBER	P1002 02 001
SHEET	88 of 140

M8

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

SIGNATURE: Thomas A. Wentz TYPED NAME: THOMAS A. WENTZ

JANUARY 6, 2006 LIC. NO. 18609

PHASE 1 - RED
PHASE 2 - BLUE

NEW EXHAUST TO SERVE FLUORIDE AND CHEMICAL STORAGE

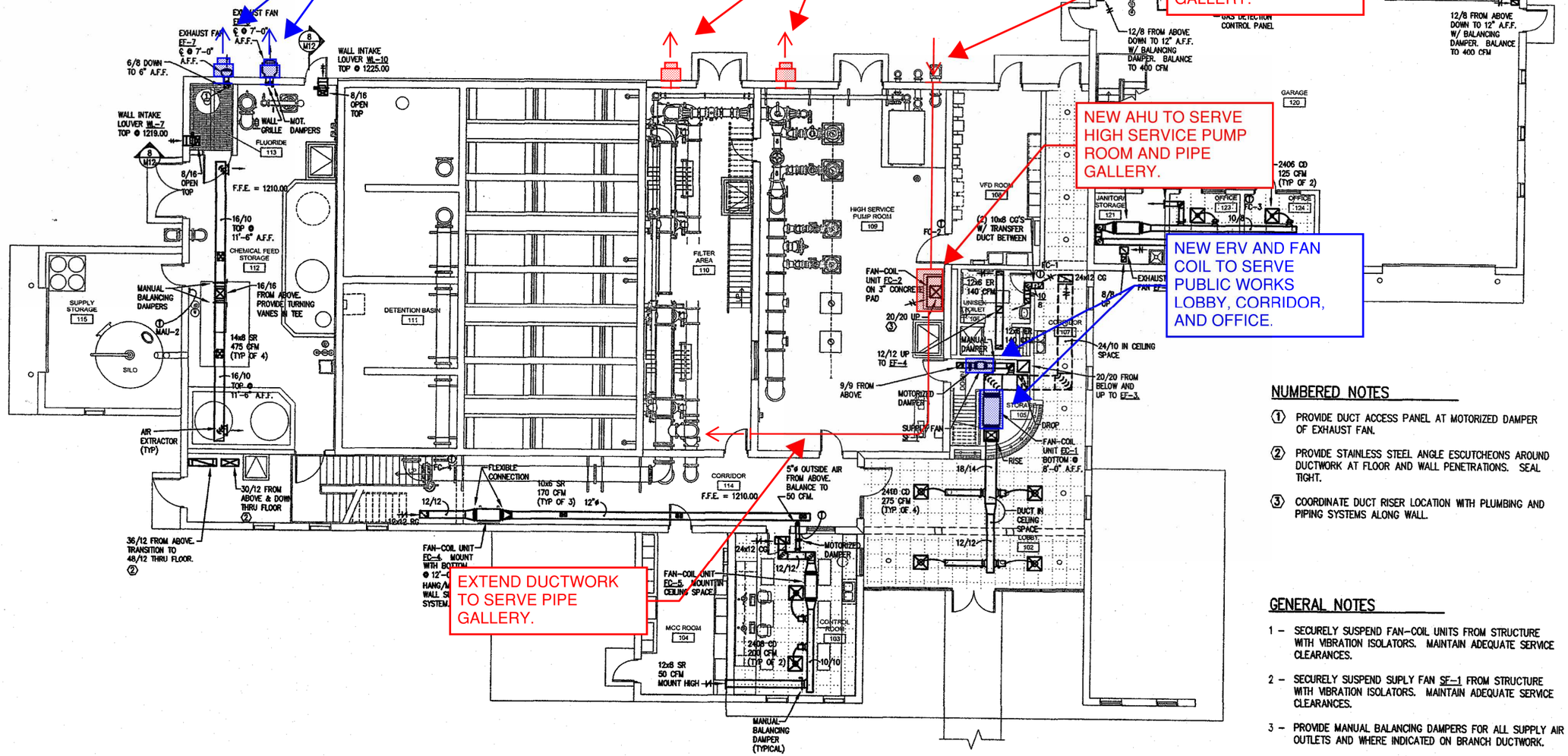
NEW EXHAUST TO SERVE PIPE GALLERY AND HIGH SERVICE PUMP ROOM.

VENTILATION INTAKE FOR HIGH SERVICE PUMP ROOM AND PIPE GALLERY.

NEW AHU TO SERVE HIGH SERVICE PUMP ROOM AND PIPE GALLERY.

NEW ERV AND FAN COIL TO SERVE PUBLIC WORKS LOBBY, CORRIDOR, AND OFFICE.

EXTEND DUCTWORK TO SERVE PIPE GALLERY.



North

MAIN FLOOR DUCTWORK PLAN

Graphic Scale 0 2 4 6 8 12 16 24

NUMBERED NOTES

① PROVIDE DUCT ACCESS PANEL AT MOTORIZED DAMPER OF EXHAUST FAN.

② PROVIDE STAINLESS STEEL ANGLE ESCUTCHEONS AROUND DUCTWORK AT FLOOR AND WALL PENETRATIONS. SEAL TIGHT.

③ COORDINATE DUCT RISER LOCATION WITH PLUMBING AND PIPING SYSTEMS ALONG WALL.

GENERAL NOTES

1 – SECURELY SUSPEND FAN-COIL UNITS FROM STRUCTURE WITH VIBRATION ISOLATORS. MAINTAIN ADEQUATE SERVICE CLEARANCES.

2 – SECURELY SUSPEND SUPLY FAN SF-1 FROM STRUCTURE WITH VIBRATION ISOLATORS. MAINTAIN ADEQUATE SERVICE CLEARANCES.

3 – PROVIDE MANUAL BALANCING DAMPERS FOR ALL SUPPLY AIR OUTLETS AND WHERE INDICATED ON BRANCH DUCTWORK.

4 – PROVIDE DUCT ACCESS PANELS AT LOCATIONS OF ALL MOTORIZED DAMPERS AND FIRE DAMPERS.

5 – DUCT CONNECTIONS TO MECHANICAL FANS AND FAN-COIL UNITS TO BE WITH FLEXIBLE CONNECTIONS.

6 – MAINTAIN REQUIRED CLEARANCES DIRECTLY OVER AND IN FRONT OF ALL ELECTRICAL PANELS AND EQUIPMENT.

7 – MAINTAIN REQUIRED SERVICE CLEARANCES AT ALL MECHANICAL EQUIPMENT.

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AE2S

MUNICIPAL WATER TREATMENT FACILITY RE-BID
CITY OF BAXTER
CITY OF BAXTER, MINNESOTA
MAIN FLOOR DUCTWORK PLAN

DRAWING TYPE	CONSTR.
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SIGNATURE: Thomas A. Wentz TYPED NAME: THOMAS A. WENTZ

JANUARY 6, 2006 LIC. NO. 18609

M6

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Sustainable buildings, sound infrastructure, safe transportation systems, clean water, renewable energy, and a balanced environment. Building a Better World for All of Us communicates a company-wide commitment to act in the best interests of our clients and the world around us.

We're confident in our ability to balance these requirements.

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