

Delaware County Regional Sewer District

# **NFPA 820 COMPLIANCE REPORT – SR, TF, LS WRF ONLY**

Analysis of Facilities and Pump Stations

April 23, 2018



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### **Analysis of Facilities and Pump Stations**

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## Contents

Contents .....	i
1 General .....	1
2 NFPA 820 Requirements.....	1
3 Facilities.....	1
3.1 Olentangy Environmental Control Center .....	2
3.2 Alum Creek Water Reclamation Facility.....	2
3.3 Scioto Reserve Wastewater Reuse Facility .....	3
3.4 Tartan Fields Wastewater Reuse Facility.....	8
3.5 Lower Scioto Water Reclamation Facility.....	11
3.6 North Star Water Reclamation Facility .....	20
3.7 Scioto Hills Waste Water Treatment Plant .....	20
3.8 Hoover Woods Waste Water Treatment Plant .....	20
3.9 Bent Tree Waste Water Treatment Plant .....	20
4 Pump Stations .....	21
4.1 Alum Creek Pump Station .....	21
4.2 Leather Lips Pump Station .....	21
4.3 Maxtown Pump Station .....	21
4.4 North Star Pump Station .....	21
5 Smaller Pump Stations .....	21
5.1 Summary .....	21
5.2 Cheshire Pump Station .....	21
5.3 Concord Pump Station .....	21
5.4 East Alum Creek Pump Station.....	21
5.5 Golf Village Pump Station .....	21
5.6 Golf Village North Pump Station.....	21
5.7 Lakes of Powell Pump Station.....	21
5.8 Peachblow Pump Station .....	21
5.9 Quail Meadows Pump Station .....	21
5.10 Scioto Reserve Pump Station .....	21

## NFPA 820 COMPLIANCE REPORT DRAFT

5.11 Summerwood Pump Station.....	21
5.12 Clear Creek Pump Station.....	21
5.13 Deer Run Pump Station .....	21
5.14 Liberty Park Pump Station.....	21
5.15 O'Shaughnessy Pump Station .....	21
5.16 Scioto Bluff Pump Station.....	21
5.17 Seldom Seen Pump Station .....	21
5.18 Sherbourne Mews Pump Station.....	21
5.19 Tartan 20 Pump Station .....	21
5.20 The Oaks Pump Station .....	21
5.21 Tillinghast Pump Station.....	21
5.22 Trotters Gait Pump Station.....	21
5.23 Verona Pump Station .....	21
5.24 Vinmar Pump Station.....	21

## TABLES

Table 1: Location and Type of Alarm Signaling Notification Appliances .....	1
Table 2: Scioto Reserve WRF Mitigation Options.....	5

## PHOTOS

Photo 1: OECC - N. Aeration Tank .....	2
Photo 2: OECC - N Aeration Tank Conduits.....	2
Photo 3: OECC - N. Aeration Tank .....	2
Photo 4: OECC - S Aeration Tanks .....	2
Photo 5: OECC - RAS Disconnects .....	2
Photo 6: ACWRF- Pendant Mounted Fixture in Screen Room.....	2
Photo 7: ACWRF- Contacts at Screen Room Door .....	2
Photo 8: ACWRF- Exit Fixture at South Door of Screen Room.....	2
Photo 9: ACWRF- Odor Control Exhaust Duct .....	2
Photo 10: ACWRF- Odor Control Room Supply Duct .....	2

NFPA 820 COMPLIANCE REPORT DRAFT

Photo 11: ACWRF - Rusted Disconnect Support Hardware at Sludge Wet Well and Scum Pit ..... 2

Photo 12: ACWRF - Sludge Wet Wells – Conduits at Actuators ..... 2

Photo 13: ACWRF- Sludge Well - Level Instrument ..... 2

Photo 14: ACWRF- Aeration Tanks - Panels on North Wall ..... 2

Photo 15: ACWRF- Aeration Tank - Mixer Panel..... 2

Photo 16: ACWRF- Aeration Tank - Panel Along Walkway..... 2

Photo 17: ACWRF- Aeration Tank - Conduits Along Walkway..... 2

Photo 18: ACWRF- Aeration Tank - Conduits Along Walkway..... 2

Photo 19: ACWRF- Influent Splitter at Clarifiers - Float Conduit ..... 2

Photo 20: ACWRF- Clarifier -Conduits at Bridge ..... 2

Photo 21: ACWRF - Skimmer Panel on Clarifier Walkway ..... 2

Photo 22: Tartan - Influent Pump Station..... 9

Photo 23: Tartan - Conduits at RAS Well ..... 9

Photo 24: Lower Scioto WRF - Actuator in Screenings ..... 14

Photo 25: Lower Scioto WRF - Sample Room Plan ..... 15

Photo 26: Lower Scioto WRF - Flow Splitter..... 16

Photo 27: Lower Scioto WRF - Aeration/Clarifier ..... 16

Photo 28: Lower Scioto WRF - Processing Pump Station..... 17

Photo 29: Lower Scioto WRF - Scum Pump Terminal Box ..... 18

Photo 30: Lower Scioto WRF – Exhaust Fan F-18..... 19

Photo 31: North Star WRF - Aeration Tanks..... 20

Photo 32: North Star WRF - Aeration Tanks..... 20

Photo 33: North Star WRF - Clarifier ..... 20

Photo 34: North Star WRF - RAS Pump Station..... 20

Photo 35: North Start WRF - RAS Pump Station..... 20

Photo 36: North Star WRF - Plant Drain Pump Station ..... 20

Photo 37: Scioto Hills WWTP – Damaged Air Intake Screen ..... 20

Photo 38: Scioto Hills WWTP – Control Building Air Intake Screen ..... 20

Photo 39: Scioto Hills WWTP - Raw/Equalization Pump CP ..... 20

Photo 40: Scioto Hills WWTP - Sludge Pumps..... 20

Photo 41: Hoover Woods WWTP - Aeration LCP ..... 20

## NFPA 820 COMPLIANCE REPORT DRAFT

Photo 42: Hoover Woods WWTP - Instrument Junction Box .....	20
Photo 43: Hoover Woods WWTP - Clarifier LCS.....	20
Photo 44: Bent Tree WWTP - Dosing Tank .....	20
Photo 45: Bent Tree WWTP- Shed.....	20
Photo 46: Leather Lips PS - Hatch in Generator Rm.....	21
Photo 47: Maxtown PS - Wet Well Vent .....	21
Photo 48: Maxtown PS - Extension Cord.....	21
Photo 49: Concord PS - Wet Well.....	21
Photo 50: O'Shaughnessy PS – Ventilation Monitoring Station .....	21
Photo 51: O'Shaughnessy PS- Grinder .....	21
Photo 52: O'Shaughnessy PS- Grinder .....	21

## FIGURES

Figure 1: Installation of Sealing Fittings at Boundary .....	1
Figure 2: Belowgrade or Partially Belowgrade Equipment Housing or Vault.....	23
Figure 3: Primary Sedimentation Tank .....	23
Figure 4: Odor Control System .....	24
Figure 5: NFPA 820 Table 4.2.2 : Classification example of a below grade pump station dry well. ....	25
Figure 6: NFPA 820 Table 5.2.2: Classification example of an enclosed screen facility.....	26
Figure 7: NFPA 820 Figure B.1.2: Typical Schematic Flow and Process Diagram of a Wastewater Treatment Plant.....	27

## APPENDICES

Appendix A: Area Classification Tables

Appendix B: Scioto Reserve NFPA 820 Mitigation List

## STANDARDS

NFPA 70	National Electrical Code
NFPA 70E	Standard for Electrical Safety in the Workplace
NFPA 820	Standard for Fire Protection in Wastewater Treatment and Collection Facilities

## ACRONYMS AND ABBREVIATIONS

ACWRF	Alum Creek Water Reclamation Facility
AHJ	Authority Having Jurisdiction
BTWWTP	Bent Tree Waste Water Treatment Plant
CGD	Combustible Gas Detection
CMF	Central Maintenance Facility
CP	Control Panel
DCRSD	Delaware County Regional Sewer District
FAS	Fire Alarm System
FDS	Fire Detection System
HWWWTP	Hoover Woods Waste Water Treatment Plant
LCS	Local Control Station
LCP	Local Control Panel
LSWRF	Lower Scioto Water Reclamation Facility
NEC	NFPA 70, National Electrical Code
NFPA	National Fire Protection Association
NSWRF	North Star Water Reclamation Facility
OECC	Olentangy Environmental Control Center
RGS	Rigid Galvanized Steel
SHWWTP	Scioto Hills Waste Water Treatment Plant
SRWRF	Scioto Reserve Water Reclamation Facility
Tartan Fields	Tartan Fields Water Reclamation Facility

## 1 GENERAL

Arcadis was retained by Delaware County Regional Sewer District (DCRSD or County) to perform an NFPA 820 Analysis of their nine (9) treatment plants (3 municipal plants and 6 package plants) and twenty-eight (28) pump stations. This analysis included:

- Development of Area Classification Tables
- Review of the Existing Ventilation Systems
- Assessment of Electrical and HVAC Systems
- NFPA 820 Compliance Report

To facilitate Development of Area Classification Tables, Arcadis performed a review of the record drawings for each facility. This review looked at the ventilation provided for the given area to determine the NFPA 820 hazardous rating for each room or area. The results were tabulated for each facility to be utilized during field investigations and can be found in Appendix A of this document.

Following the facility record drawing review, Arcadis performed site visits to verify if the actual site and installation conditions of the electrical and HVAC systems corresponded with the area classification ratings developed from the record drawing review. Arcadis also inspected each area for the existence of required support systems such as combustible gas detection and warning systems, ventilation monitoring, fire extinguishers, hydrants, and fire detection systems. During our site visits, Arcadis also made note of any non-NFPA 820 related existing conditions in the electrical or HVAC systems that would impact safety, maintenance, operations, or performance of the systems, such as highly corroded equipment or violations of working space.

In conjunction with the listing of issues, both NFPA 820 related and not, found at the facilities, an estimate of probable cost is included for each issue. The estimates are Class 4 estimates. Class 4 estimates are considered appropriate for studies or feasibility determination. They typically are done with 1% to 15% of the project definition completed and have an expected accuracy range of (-15%) to (-20%) on the low range and +20% to +50% on the high range. These estimates were calculated using an overall markup factor of 65%, which covers mobilization, insurance, bond, overhead, profit and contingency.

Area Classification Tables were developed for the sites. The tables are included in Appendix A. Each table lists the following:

- The buildings, rooms, and areas within the plant
- The hazardous rating as prescribed by NFPA 820
- Ventilation rates, if used to decrease an area's hazardous rating
- Reference to table and row of NFPA 820 applicable to the room or area
- Other requirements of NFPA 820 such as gas detection systems, fire alarm systems, etc.

## 2 NFPA 820 REQUIREMENTS

## 3 FACILITIES

The facilities visited by Arcadis each had some NFPA 820 compliance issues. Most also had some other issues that were observed during the site visits. The totalized estimation of probable cost to rectify these issues for all facilities is listed below. Each plant and pump station is covered in more detail in the text that follows.



## NFPA 820 COMPLIANCE REPORT DRAFT

### Electrical

Plants	Paragraph	Non-820 Issue	820 Issue	Total
OECC	3.1	\$23,000	\$71,000	\$94,000
Alum Creek WRF	3.2	\$46,000	\$179,000	\$225,000
Scioto Reserve <sup>1</sup>	3.3	\$2,000	\$0	\$2,000
Tartan Fields <sup>2</sup>	3.4	\$0	\$0	\$0
Lower Scioto	3.5	\$62,000	\$105,000	\$167,000
North Star	3.6	\$6,000	\$115,000	\$121,000
Scioto Hills	3.7	\$0	\$12,000	\$12,000
Hoover Woods	3.8	\$0	\$17,000	\$17,000
Bent Tree	3.9	\$0	\$10,000	\$10,000
Plant SubTotal		\$139,000	\$509,000	\$648,000
Pump Station SubTotal	4 & 5	\$18,000	\$585,000	\$603,000
<b>Total</b>		<b>\$157,000</b>	<b>\$1,094,000</b>	<b>\$1,251,000</b>
1: Does not comply with NFPA 820 but see Section 3.3.5 Options				
2: Does not comply with NFPA 820 but see Section 3.4.4 Options				

### HVAC

Plants	Paragraph	Non-820 Issue	820 Issue	Total
OECC	3.1	\$0	\$137,000	\$137,000
Alum Creek WRF	3.2	\$21,000	\$147,000	\$167,000
Scioto Reserve <sup>1</sup>	3.3	\$0	\$84,000	\$84,000
Tartan Fields <sup>2</sup>	3.4	\$0	\$41,000	\$41,000
Lower Scioto	3.5	\$0	\$81,000	\$81,000
North Star	3.6	\$2,000	\$30,000	\$32,000
Scioto Hills	3.7	\$0	\$0	\$0
Hoover Woods	3.8	\$0	\$0	\$0
Bent Tree	3.9	\$0	\$0	\$0
Plant SubTotal		\$28,000	\$520,000	\$547,000
Pump Station SubTotal	4 & 5	\$8,000	\$1,123,000	\$1,131,000
<b>Total</b>		<b>\$36,000</b>	<b>\$1,643,000</b>	<b>\$1,678,000</b>
1: Does not comply with NFPA 820 but see Section 3.3.5 Options				
2: Does not comply with NFPA 820 but see Section 3.4.4 Options				

## 3.1 Olentangy Environmental Control Center

## 3.2 Alum Creek Water Reclamation Facility

### 3.3 Scioto Reserve Wastewater Reuse Facility

On August 23, 2017, Arcadis performed a field inspection of Scioto Reserve Wastewater Reuse Facility. The package plant consists of one building. The building can be separated into the following areas:

1. Influent Pump Station/ Hydrasieve
2. Treatment
3. Electrical/Blower

In general, the equipment is not rated for use in a hazardous area. Following NFPA 820 guidelines, the areas around the Influent Pump Station and the Hydrasieve and the area around the clarifiers would be classified as Division 1. Because all the equipment is enclosed under a common roof, the entire space is classified as a Division 1 area. The electrical equipment is rated NEMA 4X in the treatment area and NEMA 12 in the Electrical/Blower area. A summary of electrical and HVAC items is shown below. More detail for each item is discussed in the following pages.

#### 3.3.1 Summary List of Electrical Issues and Estimate of Probable Costs

Building	Room	Item No.	820 Issues	Issue	Solution	Cost (\$)
WWTP		1	N	Emergency fixture SR-TB does not respond to test switch	Repair/replace fixture	\$2,000
WWTP		2	N	Conduits heavily corroded in some areas but still functional	Periodically inspect conduit system for corrosion	TBD
820 related improvement Subtotal						\$0
Non-820 related improvements Subtotal						\$2,000
Total						\$2,000

#### 3.3.2 Summary List of HVAC Issues and Estimate of Probable Costs

Building	Room	Item No.	820 Issue	Issue	Solution	Cost (\$)
WWTP	Hydrasieve Room	1	Y	Unit Heaters Located in Division 1 space are not rated for hazardous location.	Install explosion proof unit heaters and appurtenances.	\$44,100
WWTP	Treatment Room	2	Y	Exhaust fans and appurtenances not rated for Division 1 environment.	Install explosion proof exhaust fans and instruments	\$73,000
WWTP	Control Room	3	Y	Air Conditioner in the control room is not rated for a classified area	Replace with explosion proof equipment	\$10,000
820 related improvement Subtotal						\$127,000
Non-820 related improvements Subtotal						\$0
Total						\$127,000

### 3.3.3 Electrical

As noted above, the electrical equipment is not rated for use in a hazardous area. Below are additional items observed.

#### Item 1 – (Non NFPA 820)

The emergency fixture SR-TB did not respond to pressing the test switch. The light is located on the end of the tank wall facing the electrical doorway.

#### Item 2 – (Non NFPA 820)

Although the facility is under a common roof with few walls, there are areas where the equipment shows more corrosion than others. The staff should periodically observe the condition of the equipment, raceways, and supports and replace badly corroded items where necessary.

### 3.3.4 HVAC

During the site visit there were several HVAC items that were noted. The Scioto Reserve WRF is ventilated and cooled with four wall propeller fans that operate with fresh air intake louvers. The influent pumping and hydrasieve area is heated for freeze protection by two unit heaters that are not rated for hazardous areas. The Control Room is heated and cooled by a packaged terminal air conditioning unit. Because the Control Room has a door that opens to the Treatment Room, the Control Room has the same space classification as the Treatment Room and thus the terminal unit is not rated for the current space classification.

Because the spaces are Division 1 hazardous locations, ventilation at a rate of 12 air changes per hour could only be used to reduce the classification down to a Division 2 space. Most of the equipment in the package plant was not rated for a hazardous location and therefore ventilation cannot be used as the sole mitigation strategy. The motors and instruments for the exhaust fans did not appear to be explosion proof. The following items have been identified:

#### Item 1:

The unit heaters in the influent pumping and hydrasieve area are suitable for a corrosive environment only and not a hazardous location. It is recommended that these units are replaced with explosion proof unit heaters rated for a Class I Division 1 atmosphere.

#### Item 2:

The exhaust fans and their appurtenances are not appropriately rated for the hazardous locations that they are installed in. Arcadis recommends that they be replaced with fans that have explosion proof motors, disconnects, and are fabricated using spark proof construction. Although ventilation is not being run continuously to reduce the space classification, Arcadis recommends running the ventilation as frequently as possible to help reduce corrosion and the potential for hazardous gases to accumulate.

#### Item 3:

The terminal air conditioner in the control room was not rated for a classified area. Because the room has a door that opens up to the treatment area, the control room is a Division 1 area. It is recommended that the air conditioner is replaced with equipment with the appropriate rating.

### 3.3.5 Options

Because of the unique NFPA 820 conditions encountered at Scioto Reserve WRF, Arcadis facilitated a brainstorming session to identify as many options as possible to mitigate the noncompliance, regardless of the perceived feasibility of the option. Each option was then evaluated if it could offer full compliance to NFPA 820, for the anticipated capital and O&M cost, for the effects on maintenance, for the effects on the surrounding community (i.e. increased odor and/or aesthetics), and for mitigating the effects on corrosion. From this evaluation, it was determined that a feasible solution to bring the entire facility up to compliance with NFPA 820 is not apparent. Some options listed below offer conformity to NFPA 820; however, the costs to implement are not practical. For example, Option 2: replace all equipment and instruments in the space with equipment rated for a Class I Division 1 atmosphere. This option could physically be accomplished however, the cost to complete this would not be proportionate to the increase to fire protection. Below, Table 2 lists the options that Arcadis has identified to mitigate the hazard at Scioto Reserve Wastewater Reuse Facility. See Appendix B for a more detailed list.

**Table 2: Scioto Reserve WRF Mitigation Options**

Option	Mitigation Description
1*	Modify building roof or walls so that space becomes “open to atmosphere”
2*	Replace all electrical and process gear with explosion proof equipment rated for a hazardous atmosphere.
3	Isolate Electrical Room
4	Ventilate at 12 air changes per hour with heated air
5	Ventilate at 12 air changes per hour unheated
6	Pressurize all electrical boxes that can arc or spark to prevent hazardous atmosphere from leaking into panels, boxes, enclosure, etc.
7*	Add primary clarifiers prior to equalization tanks. Isolate hydrasieve and wet well area from the rest of the building.
8	Provide intermittent ventilation and combustible gas detectors. Ventilation to run when high gas levels detected.

\*Mitigation strategy alone offers NFPA 820 compliance.

Because of the physical layout at Scioto Reserve WRF, Arcadis first thought was to modify the structure to be more like a typical treatment plant where the tanks are located outside of a structure. Option 1 would remove part of the walls and roof so that the treatment process is considered outside or “open to atmosphere”. This would reduce the space area classification from Division 1 to unclassified except for the envelope areas surrounding the tanks.

Option 2 considered replacing the electrical equipment in the in the building with gear that is in the proper enclosure suitable for a Division 1 hazardous environment. This includes all the control panels, instruments, motors, outlets, motor control centers, outlets, lights, fans, unit heaters, etc. Although this option would allow the space to comply with NFPA 820, the costs associated with these replacements make this option impractical.

With a large portion of the electrical equipment located in the electrical and blower area, Option 3 would isolate the electrical room from the rest of the treatment process areas by construction a ceiling over the electrical room and eliminating the doorways between the process area and electrical room. This would allow the new isolated electrical room to be unclassified and bring the existing equipment within the electrical room to compliance. Noncompliance would still remain for the electrical equipment in the process area.

Option 4 and 5 both ventilate at 12 air changes per hour with the only difference is Option 4 is to heat the air changes. Continuous ventilation of 12 air changes per hour can be used to reduce the classification from Division 1 down to Division 2, but a majority of the equipment would still be required to be replaced because the existing equipment is rated for an unclassified space. The upfront and reoccurring costs associated with heating the ventilated air does not make Option 4 a practical solution.

The hazard of gases collecting in electrical gear and igniting can be mitigated by pressurizing the electrical gear with compressed air. Option 6 would prevent the classified atmosphere from migrating into the enclosure, but would still require replacement of some of the significant equipment. In addition, failure of the compressed air system would require alarm and an automatic shutdown of the affected equipment.

One take away from the NFPA 820 area classification tables is that, in general, the liquid stream process becomes unclassified following sedimentation. This idea was used in the development of Option 7 which is to install primary clarifiers. After the process flow has gone through the primary clarifiers all the processes to follow would become unclassified. The influent pump station and hydrasieve area would be the only location that remain classified.

The last option is to install combustible gas detectors and modify the ventilation controls to run when elevated gas levels are detected. Option 8 does not bring the facility into compliance with NFPA 820, however, this option offers a reasonable increase to fire protection at a reasonable cost.

Because there is no clear feasible option to bring the facility in compliance, Arcadis recommends a combination of options that will increase the facility's fire protection. Option 3 could be implemented to isolate the main electrical equipment and provide an appropriately rated space for future installations. Next, Option 2 could be considered over time as equipment is required to be replaced. As equipment reaches the end of its useful life, plans could be made to move equipment to the isolated electrical room. For equipment that must remain in the process space near the tanks (including lighting, fans, unit heaters), replacement equipment could be selected with the appropriate rating for a Division 1 space.

In addition to these strategies, it is recommended that Option 8 be installed as well to further increase fire protection in this facility. Although it will take some time to fully implement Option 2 and bring the entire facility to full conformance with NFPA 820, Arcadis feels this is a practical solution to mitigate the conditions that present a threat to fire protection.

### 3.3.6 Probable Cost of Recommended Options

Individual HVAC and Electrical issues and cost summaries listed above are recommended regardless of the mitigation strategy that is used. See below for the cost estimates of the recommended mitigation options.

Building	Room	Item No.	820 Issue	Issue	Solution	Cost (\$)
Treatment Plant		Option 2	Y		Replace the electrical equipment in the in the building with gear that is in the proper enclosure suitable for a Division 1 hazardous environment.	\$535,000
Treatment Plant		Option 3	Y		Isolate the electrical room from the rest of the treatment process areas by construction a ceiling over the electrical room and eliminating the doorways between the process area and electrical room.	\$265,000
Treatment Plant		Option 8	Y		install combustible gas detectors and modify the ventilation controls to run when elevated gas levels are detected.	\$91,000
820 related improvement Subtotal						\$891,000
Non-820 related improvements Subtotal						\$0
Total						\$891,000

### 3.4 Tartan Fields Wastewater Reuse Facility

On August 23, 2017, Arcadis performed a field inspection of the Tartan Fields Water Reuse Facility. The package plant consists of one building and the following equipment:

1. The Influent Pump Station is located outside at the west end of the building.
2. Treatment process equipment is located in the center area of the building.
3. Electrical equipment is located on the north side of the building along the interior wall. The generator is located outside on the north side of the building.

In general, the equipment is not rated for use in a hazardous area. Following NFPA 820 guidelines, the processes within the treatment area are classified as Division 1. Because all the equipment is enclosed under a common roof, the entire space is therefore classified as a Division 1 area. The electrical equipment is rated NEMA 4X. A summary of electrical and HVAC items is shown below. More detail for each item is discussed in the following pages

#### 3.4.1 Summary List of HVAC Issues and Estimate of Probable Costs

Building	Room	Item No.	820 Issue	Issue	Solution	Cost (\$)
WWTP	Restroom Control Room	1	Y	Unit Heater and air conditioner Located in Division 1 space are not rated for hazardous location.	Install explosion proof equipment.	\$21,000
WWTP	Treatment Room	2	Y	Exhaust fan and appurtenances not rated for Division 1 environment.	Install explosion proof exhaust fans and	\$20,000
820 related improvement Subtotal						\$41,000
Non-820 related improvements Subtotal						\$0
Total						\$41,000

#### 3.4.2 Electrical

No issues, in addition to the hazardous rating item, were found with the electrical system.

It was observed that, in general, the equipment at Tartan Fields exhibited more corrosion than at Scioto Reserve. The corrosion was not consistent and seemed to be more prevalent in different process areas, such as around the RAS wells or outside at the Influent Pump Station. None of the equipment was corroded to the point where it was posing a safety or performance issue. It is suggested that the equipment be kept under observation and replaced as work is done on the affected systems. The equipment when replaced should be of a material construction suitable for the area – i.e. rigid galvanized steel conduit should be replaced with aluminum or PVC coated RGS conduit.





Photo 22: Tartan - Influent Pump Station



Photo 23: Tartan - Conduits at RAS Well

### 3.4.3 HVAC

The package plant is ventilated with a single propeller wall fan that can switch from supply to exhaust. The fan operates with an intake/relief louver located on the opposite wall. There is no heating in the main treatment space. The Control Room is heated and cooled by a packaged terminal air conditioning unit. Because the Control Room has a door that opens to the Treatment Room the Control Room has the same space classification as the Treatment Room and thus the terminal unit is not rated for the current space classification. Likewise, the restroom in this location has a cabinet unit heater that is not rated for a classified space. The items encountered at Tartan Fields are similar to those found at Scioto Reserve.

#### Item 1:

The unit heater in the restroom and the terminal air conditioning unit serving the Control Room are not suitable for a hazardous atmosphere. It is recommended that the unit heater and air conditioner along with their appurtenances be replaced with explosion proof equipment rated for a Division 1 atmosphere.

#### Item 2:

The exhaust fan and appurtenances are not rated for the appropriate hazardous locations. Arcadis recommends that they are replaced with a fan that has an explosion proof motor, controls, and disconnect, and is fabricated using spark proof construction. It was also noted that the wall fan did not have a fan guard. The fan is seven feet above the floor and does not require a guard per OSHA, but for worker safety it is recommended a guard be installed. Although ventilation is not being run continuously to reduce the space classification, Arcadis recommends running the ventilation as frequently as possible to help reduce corrosion and the potential for hazardous gases to accumulate.



### 3.4.4 Options

Because the situation at Tartan Fields is so similar to conditions at Scioto Reserve the options to mitigate the hazardous atmosphere are the same as those presented in Table 2 in Section 3.3.3 of this report. Each option was then evaluated on if it could offer full compliance to NFPA 820, for the anticipated capital and O&M cost, for the effects on maintenance, for the effects on the surrounding community (i.e. increased odor and/or aesthetics), and for mitigating the effects on corrosion given the conditions at and surrounding Tartan Fields. From this evaluation, it was determined that a feasible solution to bring the entire facility up to compliance with NFPA 820 is not apparent. Some options listed above offer conformity to NFPA 820, however, the costs to implement are not practical.

Because there is no clear feasible option to bring the facility in compliance, Arcadis recommends a combination of options that will increase the facility's fire protection. Option 3 could be implemented to isolate the main electrical equipment and provide an appropriately rated space for future installations. Next, Option 2 could be considered over time as equipment is required to be replaced. As equipment reaches the end of its useful life, plans could be made to move equipment to the isolated electrical room. For equipment that must remain in the process space near the tanks (including lighting, fans, unit heaters), replacement equipment could be selected with the appropriate rating for a Division 1 space.

In addition to these strategies, it is recommended that Option 8 be installed as well to further increase fire protection in this facility. Although it will take some time to fully implement Option 2 and bring the entire facility to full conformance with NFPA 820, Arcadis feels this is a practical solution to mitigate the conditions that present a threat to fire protection.

### 3.4.5 Probable Cost of Recommended Options

Individual HVAC and Electrical issues and cost summaries listed above are recommended regardless of the mitigation strategy that is used. See below for the cost estimates of the recommended mitigation options.

Building	Room	Item No.	820 Issue	Issue	Solution	Cost (\$)
Treatment Plant		Option 2	Y		Replace the electrical equipment in the in the building with gear that is in the proper enclosure suitable for a Division 1 hazardous environment.	\$258,000
Treatment Plant		Option 3	Y		Isolate the electrical room from the rest of the treatment process areas by construction a ceiling over the electrical room and eliminating the doorways between the process area and electrical room.	\$128,000
Treatment Plant		Option 8	Y		install combustible gas detectors and modify the ventilation controls to run when elevated gas levels are detected.	\$97,000
820 related improvement Subtotal						\$483,000
Non-820 related improvements Subtotal						\$0
Total						\$483,000

### 3.5 Lower Scioto Water Reclamation Facility

On November 7, 2017, Arcadis performed a field inspection of Lower Scioto Water Reclamation Facility (LSWRF). The following buildings were inspected:

1. Pretreatment Building
2. Flow Splitter
3. Aeration/Clarifier Tanks
4. Process Pump Station
5. Solids Processing Building
6. Raw Sewage Pump Station
7. Digesters
8. Post Treatment
9. Administration

In general, the hazardous ratings of the areas determined in the field agreed with those contained in the area classification table. A summary of electrical and HVAC items is shown below. More detail for each item is discussed in the following pages. Some areas of concern were identified.

#### 3.5.1 Summary List of Electrical Issues and Estimate of Probable Costs

Building	Room	Item No.	820 Issues	Issue	Solution	Cost (\$)
Pretreatment	Screen	1	Y	Conduits at actuators do not have sealing fittings	Install sealing fittings	\$3,000
Pretreatment	Screen	2	N	Conduits containing intrinsically safe wiring are not labeled.	Label conduits	\$2,000
Pretreatment	Screen	3	Y	Area does not have a combustible gas detector	Install combustible gas detector system with interior and exterior audio/visual alarms	\$33,000
Pretreatment	Sample	4	Y	Sample room is rated hazardous and equipment is not rated for area	Solution to be discussed	TBD
Flow Splitter		1	Y	Existing conduits around the tank do not have sealing fittings	Install sealing fittings and relocate receptacles	\$3,000
Aeration/Clarifier	Tanks	1	Y	Existing conduits around the tank do not have sealing fittings	Install sealing fittings	\$33,000
Aeration/Clarifier	Tanks	2	Y	Existing conduits on tank walkway do not have sealing fittings	Install sealing fittings	\$11,000

NFPA 820 COMPLIANCE REPORT DRAFT

Building	Room	Item No.	820 Issues	Issue	Solution	Cost (\$)
Process Pump Station		1	Y	Existing conduits at valve actuator do not have sealing fittings	Install sealing fittings	\$2,000
Process Pump Station		2	Y	Existing conduits for submersible pump cable do not have sealing fittings	Install sealing fittings	\$2,000
Solids Processing	Sludge Rm	1	Y	Centrifuge Room is connected to other rooms making those rooms rated	Isolate centrifuge room by closing doorways or increasing ventilation. No electrical cost included.	\$0
Solids Processing	Sludge Rm	2	Y	The area does not have a fire alarm system (FAS).	Install a fire alarm system	\$18,000
Solids Processing	Sludge Pump Rm. Lower level	1	N	VFDs and starters for Centrifuge Feed Pumps and Sludge Transfer Pumps on lower level are subject to flooding	Relocate VFDs and starters to another location.	\$60,000
820 related improvement Subtotal						\$105,000
Non-820 related improvements Subtotal						\$62,000
Total						\$167,000

### 3.5.2 Summary List of HVAC Issues and Estimate of Probable Costs

Building	Room	Item No.	820 Issue	Issue	Solution	Cost (\$)
Pretreatment	Screening Room.	1	Y	Equipment in the Sample Room Is not rated for a Div. 2 atmosphere	Provide positive pressure continuous ventilation with monitoring	\$31,000
Pretreatment	Screening Room.	2	Y	Exhaust duct only has high exhaust grilles.	Modify ductwork to include lower level exhaust pickups	\$10,000
Pretreatment	Screening Room.	3	Y	Ventilation is continuous and reduces the space classification	Install ventilation monitoring and the required alarms.	\$17,000
Solids Processing	Sludge Room	1	Y	The room is Div 2 rated and the equipment is not rated for a hazardous space.	Make ventilation continuous and add a means to heat the makeup air	\$8,000
Solids Processing	Sludge Room	2	Y	Exhaust fan only expels air from the midlevel of the room.	Install exhaust duct on the fan intake to exhaust heavier and lighter than air gases or vapors.	\$7,000

Building	Room	Item No.	820 Issue	Issue	Solution	Cost (\$)
Solids Processing	Sludge Room	3	Y	Recommended ventilation is continuous and reduces the space classification	Install ventilation monitoring and the required alarms.	\$17,000
Solids Processing	Sludge Pump Room	1	Y	The room is Div. 2 rated and the equipment is not rated for a hazardous space.	Make ventilation continuous and add a means to heat the makeup air	\$8,000
Solids Processing	Sludge Pump Room	2	Y	Recommended ventilation is continuous and reduces the space classification	Install ventilation monitoring and the required alarms.	\$17,000
820 related improvement Subtotal						\$115,000
Non-820 related improvements Subtotal						\$0
Total						\$115,000

### 3.5.3 Pretreatment Building

#### 3.5.3.1 Screen Room

The Screening Room is ventilated at 12 air changes per hour to reduce the rating of the room to Division 2. 4400 CFM is supplied to the space by fan F-10 and F-11 exhausts 4700 CFM to provide the space with a negative pressure. The equipment and instruments located in this space are appropriately rated for the environment where they are located.

### 3.5.3.1.1 *Electrical*

#### Item 1:

The conduits at the gate actuators are missing sealing fittings. NEC 501.15(B)(2) requires sealing fitting in any conduit that passes thru the Division 2 boundary. The conduits to the actuators are embedded within the concrete slab and, in this case, the boundary is considered to be the top of the slab.

Arcadis recommends the conduit be reworked where it emerges from the slab to include a sealing fitting in the conduits before the transition to flexible conduit.



**Photo 24: Lower Scioto WRF - Actuator in Screenings**

#### Item 2 – (Non NFPA 820)

The door contacts are connected as intrinsically safe. The conduits are not marked as carrying intrinsically safe circuits. By NEC 504.70(B) the entire length of the raceway shall be identified with permanent labels that read “Intrinsic Safety Wiring” wherever the raceway is visible. Arcadis recommends the conduits be labelled.

#### Item 3:

NFPA 820 requires a combustible gas detection (CGD) system for the screening area. Sensors are installed within the area. However, there are no visual or audible alarms installed for either the interior or exterior of the building.

Arcadis recommends audible and visual alarms for the CGD system be installed both for the interior and at the entrances to the screening area.

#### Item 4:

A sample room is located in the southeast corner of the screening area. The sample room has a single door that connects to the screening area. As the screening area is rated as Division 2, the sample room is also rated Division 2, due to the connecting doorway. None of the equipment nor devices installed within the sample room are rated for installation in a Division 2 area.

There are a few possible solutions for this situation. One would be to replace all the equipment and devices with items rated for installation in a Division 2 area.

Another would be to close off the existing door and create a new door into an adjacent space. To isolate the sample room the door on the west wall to the screen room would be demolished and the opening filled. A new door would be required to the south or the east. A door to the south would require relocation of several control panels and conduits mounted on the other side of the wall in the blower section of the building. Some of the equipment within the room would also need to be rearranged to accommodate the new entrance.

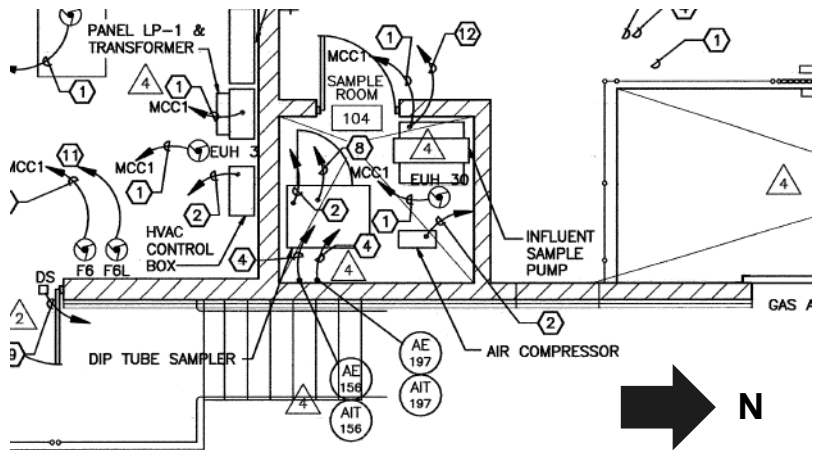


Photo 25: Lower Scioto WRF - Sample Room Plan

To add a door in the east wall would require modification of the stairs and platform for entry to the blower side of the building. The floor of the sample room is several feet above grade level. Currently the end of the stairs to the blower area are located to the east of the sample room. The existing stairs would need to be removed and the platform extended. New stairs would be needed for the combined platform. The stairs likely would need to be run down the east side of the platform to avoid interference with the rollup door access to the screen room. This would extend into the parking area for the building and push the vehicles towards the roadway. Additionally, some equipment within the sample room would need to be rearranged to coordinate with the new entrance.

Alternatively, continuous positive pressure ventilation could be provided to the sample room as described in section 3.5.3.1.2 below. The requirements of NFPA 496, Standard for Purged and Pressurized Enclosures for Electrical Equipment, for Type Z pressurization would be followed to allow the use of unclassified equipment in what would otherwise be a Division 2 environment. Type Z pressurization must be monitored and alarmed (similar to ventilation systems for derating an area). With Type Z pressurization the equipment in the room does not need to be de-energized upon a failure of the pressurization system.

### 3.5.3.1.2 HVAC

#### Item 1:

Because the sample room's only entrance is through the screen room the atmosphere in the two locations is the same. Due to the equipment in the sample room not being rated for a Division 2 location, mitigation measures are recommended. As an alternate to building a separate entrance, the room can be maintained at a positive pressure via continuous ventilation from a supply fan. It is recommended that positive pressure ventilation be installed as well as the required monitoring and alarms described below in Item 3.

#### Item 2:

The exhaust duct serving the Screen Room has two high pickups that expel air from the space. Because there are no lower exhaust pickups the ventilation does not encourage scavenging of heavier than air gases and vapors. It is recommended that the ductwork be modified to exhaust near the floor and provide adequate ventilation.



Item 3:

Because the ventilation is used to reduce the space classification, Chapter 9 of NFPA 820 requires that the ventilation is monitored, and a ventilation failure is alarmed. Likewise, if item 1 above is installed the pressure differential between the two spaces is required to be monitored and if the pressure difference is lost this must be alarmed. Arcadis recommends that ventilation monitoring be installed along with the alarms and signals in Table 1.

### 3.5.4 Flow Splitter

The area for three feet around the flow splitter is rated as Division 2. There are several instruments located within this envelope. The conduits are routed across the surface of the splitter and then into a duct bank to route back to the reporting PLC panel.

Item 1

There are no sealing fittings installed on the conduits as they exit the classified area. The receptacle that is installed at the splitter is also located within the hazardous area. It is recommended that sealing fittings be installed where the conduits enter the duct bank. Also, the receptacle should be relocated so that it is outside the classified area.



Photo 26: Lower Scioto WRF - Flow Splitter

### 3.5.5 Aeration/Clarifier Tanks

The Aeration Tanks and the Clarifiers are combined in a common structure. The outer ring functions as an aeration tank while the inner rings function as a clarifier. From the water surface to the top of the wall and an envelope 18" high and extending from the wall to 10 feet horizontally from the wall is classified as Division 2 by NFPA 820. None of the existing equipment within the envelope is rated for use in Division 2.



Photo 27: Lower Scioto WRF - Aeration/Clarifier

### 3.5.5.1.1 *Electrical*

#### Item 1

The conduits to the Aeration/Clarifier Tank pass or run through the classified area. There are no sealing fittings installed. Also, the junction boxes at the conduit stub-ups are located within the classified envelope and are not rated for use in a hazardous area. Because this is a Division 2 envelope, as long as the boxes contain only unterminated wires, terminals, taps, or splices the non-hazardous boxes are acceptable. However, sealing fittings are required in the conduits between the boxes and the underground stub-up as they cross the boundary of the classified area (grade level). The conduits which leave the box and run out the tank walkway do not require sealing fittings at the boxes as they are less than 2" conduit. The instrument that is to the left of the boxes (see Photo 27) is rated for use in Division 2 area. Its conduits will also require sealing fittings. Other conduits stub-up at lights and bubbler panels and should be treated in a similar manner.

It is recommended that sealing fittings be installed on all conduits as they stub-up from underground and before they enter the boxes, exit the classified area, or enter a panel.

#### Item 2

The Rotating Weir Control Panel, the weir actuator, and the Clarifier Control Panel are all located on the walkway across the tanks. The panels and the actuator are located above 18" and are not within the classified envelope. However, the conduits run through the envelope as they cross the aeration tank and then transition to running above the envelope at the edge of the clarifier. There are expansion fittings installed in the conduits as they transition from the aeration tank to the clarifier tank. Sealing fittings are required to be installed where the conduits cross the boundary, near the expansion fittings.

## 3.5.6 **Process Pump Station**

This building was designed with opening on three sides of the structure. The intent was to provide enough open area in the walls (approximately 50%) so that the wet wells could be considered to be "not enclosed". The Scum Pit Wet Well, and an area for 10 feet horizontally around the wet well, is classified as a Division 2 area. The remainder of the under-roof area is unclassified.

#### Item 1

The actuator for the northern telescoping valve in the RAS/WAS wet well is within the classified zone around the wet well. The bubbler panel located in the northeast corner of the building is also within the 10 foot radius envelope around the well. Neither device is rated for use within the Division 2 area.

The conduits associated with the bubbler are routed across the ceiling and therefore do not intrude into the envelope. No changes are required at the bubbler.

The conduits for the actuator emerge from the slab directly below the actuator. There are no



Photo 28: Lower Scioto WRF - Processing Pump Station



sealing fittings installed on the existing conduits. Sealing fittings should be installed on the three conduits as they cross the classified envelope.

Item 2

The pump cables run from each wet well through a conduit which stub-ups up from the slab to an air gap between the conduit and a terminal box located on the east wall of the structure. The two conduits associated with the scum pumps run from the Scum Pit Wet Well, which is rated as Division 2, to the air gap. As the two conduits originate in a rated area they will behave similar to a vent and have an envelope of three foot radius around the end of the conduits which would encompass the terminal boxes. Therefore, the two conduits should have sealing fittings installed as the conduit stub-up from the slab.

### 3.5.7 Solids Processing Building

#### 3.5.7.1 Sludge Room

The Sludge Room contains a centrifuge and has non-continuous ventilation. Therefore, by NFPA 820 table 6.2.2, row 12, line b, the room is rated as Division 2. The attached rooms, Blower Room, Electrical Room and the Raw Sewage Electrical Room are also rated because there are doorways connecting them to the Sludge Room. None of these areas are constructed with rated devices or equipment and there are no sealing fittings installed anywhere. A fire alarm system, FAS, is also required for the area but is not installed. The Sludge Room is provided with 1000 CFM via supply louver L18A and exhaust fan F-18 amounting to six air changes per hour. The current ventilation operates intermittently and does not have a means to temper the incoming air other than the unit heaters in the space. The space is currently rated as a Division 2 space.

Under the version of NFPA 820 in effect when the building was constructed, circa 2008, centrifuge areas were not rated. Therefore, the installation was compliant when it was constructed. An FAS was required by NFPA 820 at the time of installation.



Photo 29: Lower Scioto WRF - Scum Pump Terminal Box

##### 3.5.7.1.1 Electrical

Item 1

To bring the building into compliance with the current version of NFPA 820, there are two alternatives. One would be to close off the connecting doorways to the other rooms to isolate the centrifuge room. The rating of these rooms, Blower Room, Electrical Room, and Raw Sewage Control Room would then be unclassified. However, a second door would have to be cut into the electrical room as the equipment inside is large enough that two exits from the room are required by the NEC. Adding a second door would require either relocation of panels within the electrical room to create space for a door on the east exterior wall. It would be difficult to create a door on the south wall without creating interferences with the hatches to access the raw sewage pumps.

The second alternative would involve changes to the ventilation and will be discussed further in the HVAC section below. See Item 1 from section 3.5.7.1.2 below

Item 2

The Sludge Room does not have a fire alarm system (FAS) installed. Both the current and the older versions of NFPA 820 required an FAS to be installed in dewatering areas, whether the area is continuously ventilated or not. An FAS should be installed for the sludge room.

3.5.7.1.2 HVAC

Item 1

To declassify the space, Arcadis recommends that the ventilation is changed over to be continuous and a duct heater is added to temper the incoming air. When the ventilation is made continuous and the space is not occupied the overhead doors should remain closed to isolate the unclassified spaces.

Item 2

Currently the inline exhaust fan located in the Sludge Room, F-18, is installed with a screened intake on the end of the fan. As installed the ventilation only encourages exhausting air from the mid-level of the room and neglects the upper and lower levels. It is also recommended that the ductwork be added to the end of the fan and extended up to the ceiling and down to within a foot of the floor to scavenge from all areas of the room.

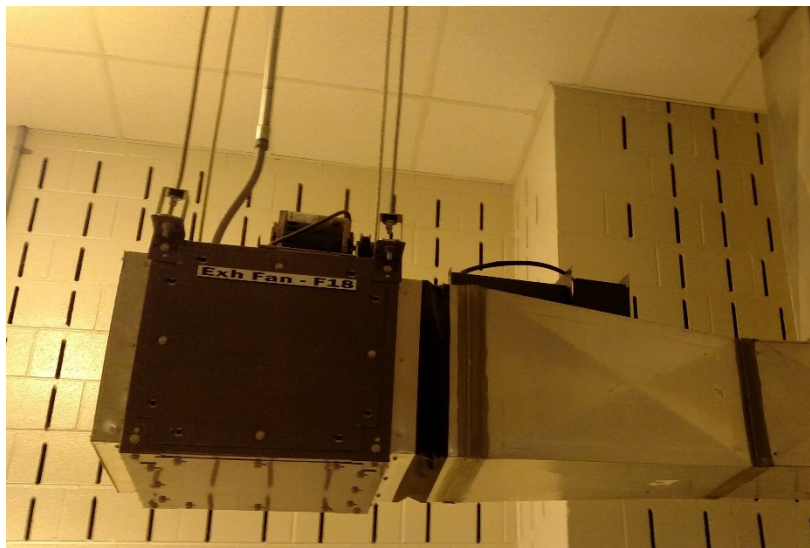


Photo 30: Lower Scioto WRF – Exhaust Fan F-18

Item 3

The recommendation from item 1 above uses ventilation to reduce the area classification. Because of this it is recommended that ventilation monitoring be installed in accordance with Chapter 7.5 of the 2016 edition of NFPA 820 and the alarms listed in Table 1.

3.5.7.2 Sludge Pump Room (lower level)

The lower level houses the sludge pumps and odor control fan. Per NFPA 820, table 6.2.2, row 9, line a, the room is classified as a Division 2 environment. The room would also be classified as a Division 2 area due to the odor control fan being located here per NFPA 820, table 4.2.2, row 20, line a. The Sludge Pump Room is provided with 1300 CFM or six air changes per hour of ventilation. There is not a means to temper the incoming air and the ventilation is not being run continuously. Equipment such as the lighting fixtures and equipment controls are not rated for a classified environment. During the site visit DCRSD staff indicated that the area is susceptible to flooding and when investigated it was observed that all the process and electrical equipment had be damaged due to this.

#### 3.5.7.2.1 *Electrical*

##### Item 1 - (Non NFPA 820)

Staff indicated that the VFDs and starters located in the space that serve the sludge pumps and odor control fan have been damaged due to the sewage overflows. Arcadis recommends that the VFDs and starters be relocated to the blower room to prevent damage from possible flooding.

#### 3.5.7.2.2 *HVAC*

##### Item 1

To declassify the space Arcadis recommends that the ventilation is changed over to be continuous. When the ventilation is made continuous a duct heater should be added to the ventilation system to temper the outside air as needed. There will still be a hazardous envelope located within 3 feet around the odor control fan, ductwork flanges and flexible connectors per NFPA 820 table 4.2.2, row 20, line b. No equipment was located with this envelope during the site visit, however, as damaged equipment is put back into service these hazardous envelopes should be noted.

##### Item 2

The recommendation from item 1 above uses ventilation to reduce the area classification. Because of this it is recommended that ventilation monitoring be installed in the drywell.

### **3.5.8 Raw Sewage Pump Station**

No issues were found within this area.

### **3.5.9 Aerobic Digesters**

The aerobic digester area is not classified as hazardous. No other issues were found.

### **3.5.10 Post Treatment**

The various rooms and areas that make up the post treatment building are not classified as hazardous. No other issues were found.

### **3.5.11 Administration**

The various rooms and areas that make up the Administration building are not classified as hazardous. No other issues were found.

## **3.6 North Star Water Reclamation Facility**

## **3.7 Scioto Hills Waste Water Treatment Plant**

## **3.8 Hoover Woods Waste Water Treatment Plant**

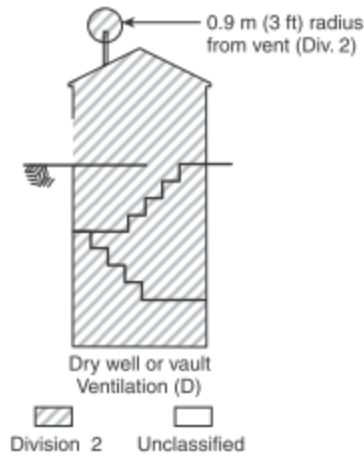
## **3.9 Bent Tree Waste Water Treatment Plant**

## 4 PUMP STATIONS

## 5 SMALLER PUMP STATIONS

# FIGURES

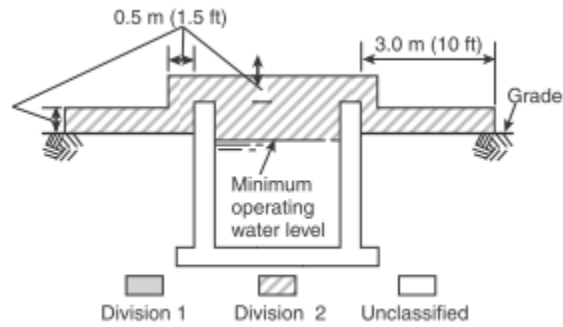




Belowgrade or Partially Belowgrade Equipment Housing or Vault Physically Separated from Wet Well or Basin; Illustration of NFPA 820 Table 4.2.2, Rows 5, 12, 17, 31 and 36.

**Figure 2: Belowgrade or Partially Belowgrade Equipment Housing or Vault**

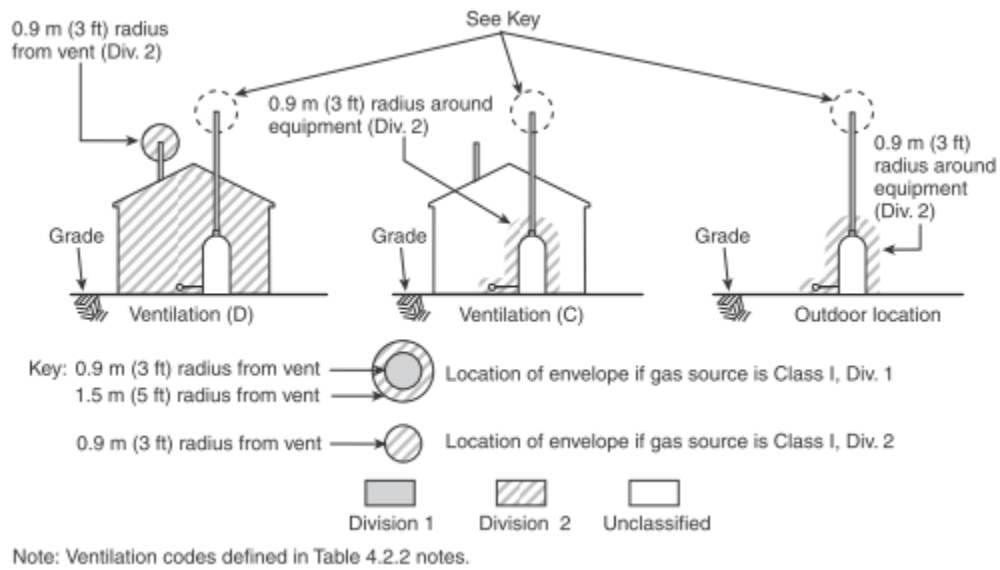
Figure from NFPA 820, Standard for Fire Protection in Wastewater Treatment and Collection Facilities, 2016 Edition – Figure A.4.2(e)



Primary Sedimentation Tank; Illustration of NFPA 820 Table 5.2.2, Row 7.

**Figure 3: Primary Sedimentation Tank**

Information from NFPA 820, Standard for Fire Protection in Wastewater Treatment and Collection Facilities, 2016 Edition – Figure A.5.2



Odor Control System Location Physically Separated from Wet Well; Illustration of NFPA 820 Table 4.2.2, Row 20.

Figure 4: Odor Control System

Figure from NFPA 820, Standard for Fire Protection in Wastewater Treatment and Collection Facilities, 2016 Edition – Figure A.4.2(g)

NFPA 820 Table 4.2.2

Row*	Line*	Location and Function	Fire and Explosion Hazard	Ventilation <sup>b</sup>	Extent of Classified Area	NEC Area Electrical Classification (All Class I, Group D)	Materials of Construction <sup>c</sup>	Fire Protection Measures
16	a	WASTEWATER PUMPING STATION WET WELLS Liquid side of a pumping station serving a sanitary sewer or combined system	Possible ignition of flammable gases and floating flammable liquids	A	Entire room or space	Division 1	NC, LC, or LFS	CGD required if mechanically ventilated or opens into a building interior
	B			Entire room or space	Division 2	NC, LC, or LFS	CGD	
17	a	BELOWGRADE OR PARTIALLY BELOWGRADE WASTEWATER PUMPING STATION DRY WELL. Pump room physically separated from wet well; pumping of wastewater from a sanitary or combined sewer system through closed pumps and pipes	Buildup of vapors from flammable or combustible liquids	C	Entire space or room	Unclassified	NC, LC, or LFS	FE
	b			D	Entire space or room	Division 2	NC, LC, or LFS	FE

Note: The following codes are used in this table:

A: No ventilation or ventilated at less than 12 air changes per hour

B: Continuously ventilated at 12 changes per hour

C: Continuously ventilated at six air changes per hour

CGD: Combustible gas detection system

D: No ventilation or ventilated at less than six air changes per hour

FDS: Fire detection system

FE: Portable fire extinguisher

Example of a below grade pump station dry well ventilated continuously at “C”, six air changes per hour. The space would be reduced from Division 2 at “D”, no ventilation or less than six air changes per hour, to unclassified at “C”, or six air changes per hour continuous

Figure 5: NFPA 820 Table 4.2.2 : Classification example of a below grade pump station dry well.

Information from NFPA 820, Standard for Fire Protection in Wastewater Treatment and Collection Facilities, 2016 Edition



NFPA 820 Table 5.2.2

Row*	Line*	Location and Function	Fire and Explosion Hazard	Ventilation <sup>b</sup>	Extent of Classified Area <sup>a</sup>	NEC Area Electrical Classification (All Class I, Group D) <sup>d</sup>	Materials of Construction <sup>c</sup>	Fire Protection Measures
1	a	DIVERSION AND CONTROL STRUCTURES Not preceded by primary treatment	Possible ignition of flammable gases and floating flammable liquids	A	Enclosed—entire space	Division 1	NC	FE, H, CGD if enclosed in building
	b			B	Enclosed—entire space	Division 2	NC, LC, or LFS	FE, H, CGD if enclosed in a building
	c			Not enclosed, open to atmosphere	Within a 3 m (10 ft) envelope around equipment and open channel	Division 2	NC, LC, or LFS	FE and H
2	a	COARSE AND FINE SCREEN FACILITIES Removal of screenings from raw wastewater	Possible ignition of flammable gases and floating flammable liquids	A	Enclosed—entire space	Division 1	NC	FE, H, CGD
	b			B	Enclosed—entire space	Division 2	NC, LC, or LFS	FE, H, CGD
	c			Not enclosed, open to atmosphere	Within a 3 m (10 ft) envelope around equipment and open channel	Division 2	NC, LC, or LFS	FE, H

Note: The following codes are used in this table:

A: No ventilation or ventilated at less than 12 air changes per hour

B: Continuously ventilated at 12 changes per hour

C: Continuously ventilated at six air changes per hour

CGD: Combustible gas detection system

D: No ventilation or ventilated at less than six air changes per hour

FDS: Fire detection system

FE: Portable fire extinguisher

**NFPA 820 Table 5.2.2: Classification Example of an enclosed screen facility ventilated continuously at “B”, 12 air changes per hour. The space would be reduced from a Division 1 space at “A”, or no ventilation, to Division 2 at “B” ventilation, 12 air changes per hour**

**Figure 6: NFPA 820 Table 5.2.2: Classification example of an enclosed screen facility.**

Information from NFPA 820, Standard for Fire Protection in Wastewater Treatment and Collection Facilities, 2016 Edition

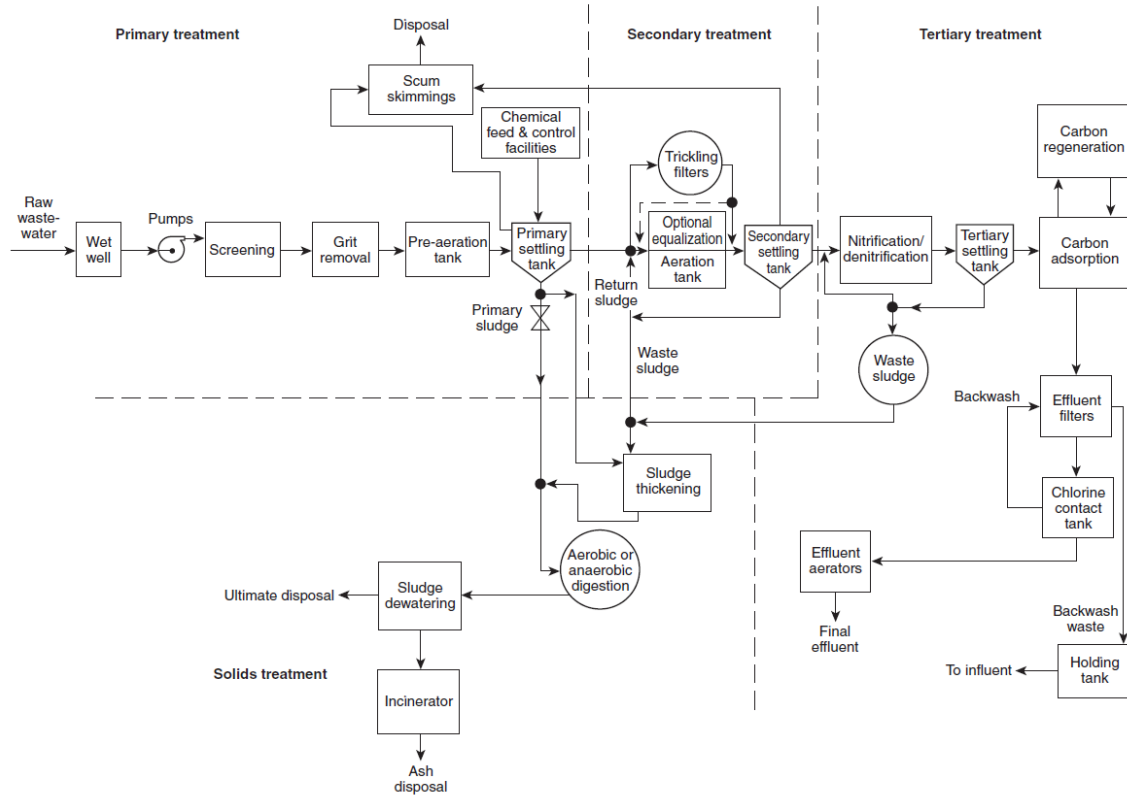


FIGURE B.1.2 Typical Schematic Flow and Process Diagram of a Wastewater Treatment Plant.

Figure 7: NFPA 820 Figure B.1.2: Typical Schematic Flow and Process Diagram of a Wastewater Treatment Plant.

Information from NFPA 820, Standard for Fire Protection in Wastewater Treatment and Collection Facilities, 2016 Edition

# APPENDIX A

## Area Classification Tables

3.1 – Olentangy Environmental Control Center

3.2 – Alum Creek Water Reclamation Facility

3.3– Scioto Reserve Wastewater Reuse Facility

3.4 – Tartan Fields Wastewater Reuse Facility

3.5– Lower Scioto Water Reclamation Facility

3.6– North Star Water Reclamation Facility

3.7– Scioto Hills Wastewater Treatment Plant

3.8– Hoover Woods Wastewater Treatment Plant

3.9– Bent Tree Wastewater Treatment Plant

4.1 – Alum Creek Pump Station

4.2– Leatherlips Pump Station

4.3– Maxtown Pump Station

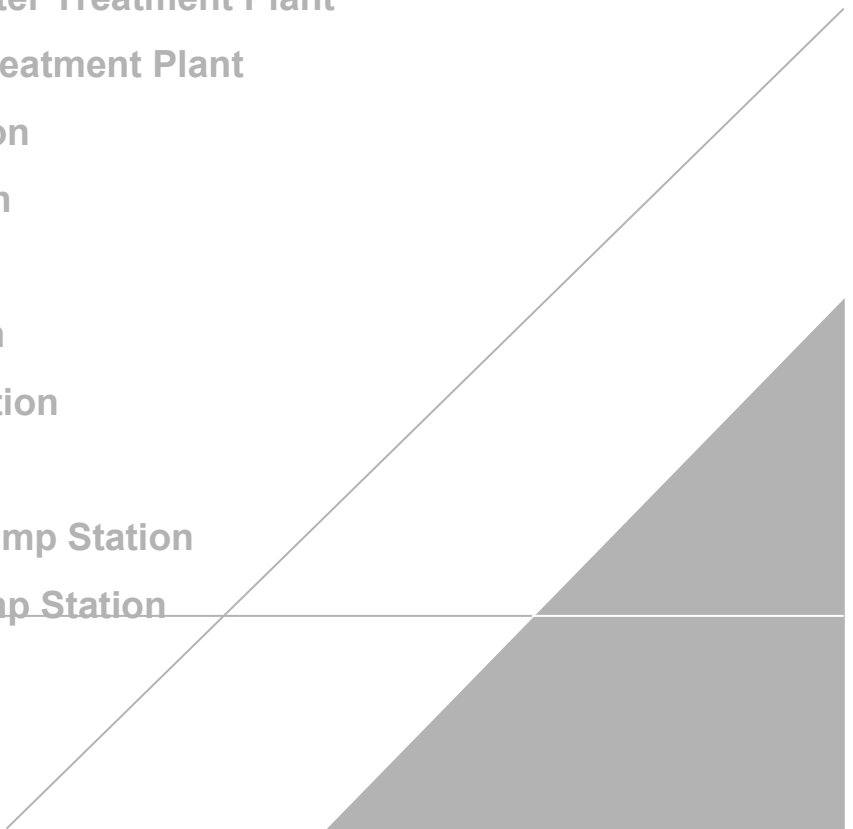
4.4 – North Star Pump Station

5.14 – Liberty Park Pump Station

5.23 – Verona Pump Station

5.A – Typical Mixed Waste Pump Station

5.B – Typical Residential Pump Station



### 3.3 - SCIOTO RESERVE WASTEWATER REUSE FACILITY AREA CLASSIFICATION TABLE

AREA	AREA CLASSIFICATION (WET, DRY, HAZARDOUS) <sup>1</sup>	HAZARDOUS CLASSIFICATIONS (UNCLASSIFIED, CLASS I DIV 1, CLASS I DIV2)	VENTILATION USED TO REDUCE CLASSIFICATION	AIR CHANGES PER HOUR	NFPA 820 TABLE- ROW (2016 ED.)	REMARK
<b>GENERAL</b>						
GENERAL OUTDOOR AREA	WET	UNCLASSIFIED	NA	-	--	
<b>TREATMENT ROOM AND CONNECTED AREAS</b>						
INTERIOR OF BUILDING	CORROSIVE HAZARDOUS	CLASS I, DIV 1	N	-	5.2.2-2.a	ENCLOSED H:HYDRANT FE: FIRE EXTINGUISHER CGD: COMBUSTIBLE GAS DETECTOR

<sup>1</sup> AREA CLASSIFICATIONS ARE RECOMMENDATIONS BASED ON THE TYPICAL ENVIRONMENT FOR THESE TYPES OF SPACES.

<sup>2</sup> SUGGESTED MATERIALS ARE RECOMMENDATIONS BASED ON ARCADIS STANDARD DESIGN.

NOTES:

1. NEMA 4X STAINLESS STEEL ENCLOSURE UNLESS ARCING CONTACT PRESENT. IF ARCING CONTACTS PRESENT, ENCLOSURE SHALL BE EXPLOSION PROOF.
2. NO TOP CONDUIT ENTRY ALLOWED.

### 3.4 - TARTAN FIELDS WASTEWATER REUSE FACILITY AREA CLASSIFICATION TABLE

AREA	AREA CLASSIFICATION (WET, DRY, HAZARDOUS) <sup>1</sup>	HAZARDOUS CLASSIFICATIONS (UNCLASSIFIED, CLASS I DIV 1, CLASS I DIV2)	VENTILATION USED TO REDUCE CLASSIFICATION	AIR CHANGES PER HOUR	NFPA 820 TABLE- ROW (2016 ED.)	REMARK
<b>GENERAL</b>						
GENERAL OUTDOOR AREA	WET	UNCLASSIFIED	NA	-	--	
<b>TREATMENT ROOM AND CONNECTED AREAS</b>						
INTERIOR OF BUILDING	CORROSIVE HAZARDOUS	CLASS I, DIV 1	N	-	5.2.2-2.a	ENCLOSED H:HYDRANT FE: FIRE EXTINGUISHER CGD: COMBUSTIBLE GAS DETECTOR

<sup>1</sup> AREA CLASSIFICATIONS ARE RECOMMENDATIONS BASED ON THE TYPICAL ENVIRONMENT FOR THESE TYPES OF SPACES.

<sup>2</sup> SUGGESTED MATERIALS ARE RECOMMENDATIONS BASED ON ARCADIS STANDARD DESIGN.

**NOTES:**

1. NEMA 4X STAINLESS STEEL ENCLOSURE UNLESS ARCING CONTACT PRESENT. IF ARCING CONTACTS PRESENT, ENCLOSURE SHALL BE EXPLOSION PROOF.
2. NO TOP CONDUIT ENTRY ALLOWED.

### 3.5 - LOWER SCIOTO WATER RECLAMATION FACILITY AREA CLASSIFICATION TABLE

AREA	AREA CLASSIFICATION (WET, DRY, HAZARDOUS) <sup>1</sup>	HAZARDOUS CLASSIFICATIONS (UNCLASSIFIED, CLASS I DIV 1, CLASS I DIV2)	VENTILATION USED TO REDUCE CLASSIFICATION	AIR CHANGES PER HOUR	NFPA 820 TABLE- ROW (2016 ED.)	REMARK
<b>GENERAL</b>						
GENERAL OUTDOOR AREA	WET	UNCLASSIFIED	N	-	--	
<b>ADMINISTRATION BUILDING</b>						
ALL OTHER AREAS	DRY	UNCLASSIFIED	N	-	--	
RESTROOM	DRY/DAMP	UNCLASSIFIED	N	-	--	
<b>PRETREATMENT BUILDING</b>						
SCREENING ROOM	CORROSIVE HAZARDOUS	CLASS I, DIV 2	Y	12	5.2.2-2.b	FE: PORTABLE FIRE EXTINGUISHER H: HYDRANT PROTECTION CGD: COMBUSTIBLE GAS DETECTION SYSTEM
BLOWER ROOM	DRY	UNCLASSIFIED	N	-	--	
<b>AERATION TANKS</b>						
INTERIOR OF TANK	CORROSIVE HAZARDOUS	CLASS I, DIV 2	N	-	5.2.2-7.c	OPEN TO ATMOSPHERE NOT PRECEDED BY PRIMARY SEDIMENTATION H:HYDRANT
ENVELOPE 18 INCHES ABOVE TANK OPENING AND EXTENDING 18 INCHES BEYOND TANK EXTERIOR WALL	CORROSIVE HAZARDOUS	CLASS I, DIV 2	N	-	5.2.2-7.c	AREA BEYOND ENVELOPE IS UNCLASSIFIED H
ENVELOPE 18 INCHES ABOVE TANK GRADE EXTENDING 10 FEET HORIZONTALLY FROM TANK EXTERIOR WALL	CORROSIVE HAZARDOUS	CLASS I, DIV 2	N	-	5.2.2-7.c	AREA BEYOND ENVELOPE IS UNCLASSIFIED H
<b>CLARIFIER</b>						
INTERIOR OF TANK	CORROSIVE HAZARDOUS	CLASS I, DIV 2	N	-	5.2.2-7.c	OPEN TO ATMOSPHERE NOT PRECEDED BY PRIMARY SEDIMENTATION H: HYDRANT
ENVELOPE 18 INCHES ABOVE TANK OPENING AND EXTENDING 18 INCHES BEYOND TANK EXTERIOR WALL	CORROSIVE HAZARDOUS	CLASS I, DIV 2	N	-	ANNEX A FIG A.5.2	AREA BEYOND ENVELOPE IS UNCLASSIFIED H
ENVELOPE 18 INCHES ABOVE TANK GRADE EXTENDING 10 FEET HORIZONTALLY FROM TANK EXTERIOR WALL	CORROSIVE HAZARDOUS	CLASS I, DIV 2	N	-	ANNEX A FIG A.5.2	AREA BEYOND ENVELOPE IS UNCLASSIFIED H
<b>FLOW SPLITTER</b>						
FLOW SPLITTER	WET					
	CORROSIVE HAZARDOUS	CLASS I, DIV 1	N	-	5.2.2-1.a	OPEN TO ATMOSPHERE NOT PRECEDED BY PRIMARY SEDIMENTATION
WITHIN 3 FT OF CLARIFIER INFLUENT SPLITTER EQUIPMENT AND OPEN CHANNEL	CORROSIVE HAZARDOUS	CLASS I, DIV 2	N	-	5.2.2-1.c	OPEN TO ATMOSPHERE NOT PRECEDED BY PRIMARY SEDIMENTATION
<b>PROCESS PUMP STATION</b>						
SLUDGE LIQUOR WELL	CORROSIVE	UNCLASSIFIED	N	-	-	
SCUM WELL	CORROSIVE HAZARDOUS	CLASS I, DIV 2	N	-	6.2.2(a)-4.c	OPEN TO ATMOSPHERE
WITHIN 10 FT. OF SCUM WELL OPENING	CORROSIVE HAZARDOUS	CLASS I, DIV 2	N	-	6.2.2(a)-4.c	OPEN TO ATMOSPHERE
RAS/WAS WELL	CORROSIVE HAZARDOUS	CLASS I, DIV 2	N	-	6.2.2(a)-10.c	OPEN TO ATMOSPHERE
18 INCHES ABOVE WATER SURFACE WITHIN 10 FT. HORIZONTALLY OF WETTED WALLS OF RAS WELL	CORROSIVE HAZARDOUS	CLASS I, DIV 2	N	-	6.2.2(a)-10.c	OPEN TO ATMOSPHERE
<b>SOLIDS PROCESSING BUILDING</b>						

AREA	AREA CLASSIFICATION (WET, DRY, HAZARDOUS) <sup>1</sup>	HAZARDOUS CLASSIFICATIONS (UNCLASSIFIED, CLASS I DIV 1, CLASS I DIV 2)	VENTILATION USED TO REDUCE CLASSIFICATION	AIR CHANGES PER HOUR	NFPA 820 TABLE- ROW (2016 ED.)	REMARK
SLUDGE ROOM	CORROSIVE HAZARDOUS	CLASS I, DIV 2	N	7	6.2.2-12.b	H: HYDRANT FE: FIRE EXTINGUISHER FAS: FIRE ALARM SYSTEM
BLOWER AREA	DRY	UNCLASSIFIED	N	-	--	
BLOWER AREA	DRY	CLASS I, DIV 2	N	--	--	CONNECTED TO SLUDGE ROOM WITH OPEN DOOR WAY
SOLIDS ELECTRICAL ROOM	DRY	CLASS I, DIV 2	N	--	--	CONNECTED TO SLUDGE ROOM WITH DOOR WAY
RAW SEWAGE PUMP ELECTRICAL ROOM	DRY	CLASS I, DIV 2	N	--	--	CONNECTED TO SLUDGE ROOM WITH DOOR WAY
SLUDGE PUMP ROOM	CORROSIVE	UNCLASSIFIED	Y	6	6.2.2-12.a	H FE
SLUDGE LOADING	CORROSIVE HAZARDOUS	CLASS I, DIV 2	N	6	6.2.2-13.c	H: HYDRANT FE: FIRE EXTINGUISHER FAS: FIRE ALARM SYSTEM
<b>RAW SEWAGE PUMP STATION</b>						
WET WELL	CORROSIVE HAZARDOUS	CLASS I, DIV 1	N	-	4.2.2-16.a	CGD: COMBUSTIBLE GAS DETECTION
DRY WELL	CORROSIVE HAZARDOUS	CLASS I, DIV 2	N	-	4.2.2-17.b	FE: FIRE EXTINGUISHER
RAW SEWAGE PUMP STATION UPPER FLOOR	CORROSIVE HAZARDOUS	CLASS I, DIV 1	N	-	FIGURE A.4.2.f	FE: FIRE EXTINGUISHER
3 FT ENVELOPE AROUND OPENINGS	CORROSIVE HAZARDOUS	CLASS I, DIV 2	N	-	FIGURE A.4.2.f	
CONTROL ROOM	DRY	UNCLASSIFIED	N	-	--	
<b>AEROBIC DIGESTERS (STORAGE TANKS)</b>						
DIGESTORS	WET	UNCLASSIFIED	N	-	-	
<b>POST TREATMENT BUILDING</b>						
FILTER ROOM	WET	UNCLASSIFIED	N	-	5.2.2-22	
UV ROOM	WET	UNCLASSIFIED	N	-	5.2.2-26	
CHEMICAL FEED ROOM	CORROSIVE	UNCLASSIFIED	N	-	--	
POST AERATION	WET	UNCLASSIFIED	N	-	5.2.2-11	
PUMP ROOM	WET	UNCLASSIFIED	N	-	--	
BLOWER ROOM	DRY	UNCLASSIFIED	N	-	--	
ELECTRICAL ROOM	DRY	UNCLASSIFIED	N	-	--	
<b>PRETREATMENT BIOFILTER</b>						
AREAS WITHIN 3 FT OF LEAKAGE SOURCES	CORROSIVE HAZARDOUS	CLASS I, DIV 2	N	-	4.2.2-20.d	FE
AREAS BEYOND 3 FT	WET	UNCLASSIFIED	N	-	4.2.2-20.e	
<sup>1</sup> AREA CLASSIFICATIONS ARE RECOMMENDATIONS BASED ON THE TYPICAL ENVIRONMENT FOR THESE TYPES OF SPACES. <sup>2</sup> SUGGESTED MATERIALS ARE RECOMMENDATIONS BASED ON ARCADIS STANDARD DESIGN.						NOTES:  1. NEMA 4X STAINLESS STEEL ENCLOSURE UNLESS ARCING CONTACT PRESENT. IF ARCING CONTACTS PRESENT, ENCLOSURE SHALL BE EXPLOSION PROOF. 2. NO TOP CONDUIT ENTRY ALLOWED.

# APPENDIX B

## Scioto Reserve NFPA 820 Mitigation List





**Delaware County NFPA 820 - Scioto Reserve WRF**

**Positive Effect: + Negative Effect: -**

Option	Compliance with NFPA 820	Costs		Maintenance	Community Effect	Corrosion Effects	Notes/Comments
		Capital	O&M				
<b>Option 1:</b> Modify building walls or roof to change area to an open to the atmosphere area, changing the space classification from CID1 to Unclassified (table 5.2.2 row 7 line a "Enclosed - Entire Space" to line c, "Not Enclosed, open to atmosphere.")	+	\$		-	-	+	-Space becomes unclassified except for tank envelope 18 inches above top of tank extending 18 inches beyond tank wall and 18 inches above grade extending 3 feet horizontally from tank.
<b>Option 2:</b> Replace all electrical and process gear with explosion proof equipment rated for a hazardous atmosphere.	+	\$\$\$	\$	-		+	-Higher future replacement costs as well.
<b>Option 3:</b> Isolate electrical room. Wall off doors to hydrasieve room, process room and add roof to separate space from process area.		\$\$				+	-Positive corrosion effect on new enclosed elec room only.
<b>Option 4:</b> Provide Continuous ventilation at 12 air changes per hour to mitigate hazard with outside air tempering (heating). Reduce space classification from CID1 down to CID2. Specify future equipment for CID2 hazardous environment.		\$\$\$	\$\$	-	-	+	
<b>Option 5:</b> Provide Continuous ventilation at 12 air changes per hour to mitigate hazard without outside air tempering (heating). Reduce space classification from CID2 down to CID2. Specify future equipment for CID2 hazardous environment.		\$	\$	-	-	+	
<b>Option 6 :</b> Pressurize all electrical boxes that can arc or spark to prevent hazardous atmosphere from leaking into panels, boxes, enclosure, etc.		\$\$	\$	-		+	-Positive corrosion effect on interior of panels only. -Motors, lights, outlets, etc. not rated for space
<b>Option 7:</b> Add primary clarifiers prior to equalization tanks. Isolate hydrasieve and wet well area from the rest of the building.	+	\$\$\$	\$	-	-	+	
<b>Option 8:</b> Provide intermittent ventilation and combustible gas detectors. Ventilation to run when high gas levels detected.		\$	\$	-	-	+	

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