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Preventative Maintenance and Malfunction Abatement Program
For
US Ecology Company, Michigan
Renewable Operating Permit

49350 North I-94 Service Drive
Belleville, Michigan 48111





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1. GENERAL

1.1. SUMMARY

Michigan Disposal Waste Treatment Plant (MDWTP) is permitted to process 210.44 million gallons of waste. The plant primarily consists of hazardous waste regulated by the Resource Conservation and Recovery Act (RCRA), but the treatment plant may also treat non-hazardous waste. MDWTP may treat volatile organic compound (VOC) bearing waste that is subject to control requirements under 40 CFR 63 Subpart DD and 40 CFR 264 Subpart CC. The facility Renewable Operating Permit provides restriction to the VOC content that may be present in the waste.

MDWTP's treatment process combines like waste for centralized waste treatment in one of eight treatment tanks located in the East Treatment Building (ETB) and West Treatment Building (WTB). The buildings process waste in the same manner; however, differ in the air pollution control devices present. Processing includes the addition of various reagents in order to destroy or stabilize contaminants present in the waste to meet land disposal restrictions established by RCRA.

1.2. PURPOSE

The purpose of this document is to provide a formal process specification and functional description for the Baghouse Controls Upgrade System at the USEM Belleville, MI plant.


1.3. DOCUMENT SCOPE

Covers the operational sequence, controls system architecture and functional details of the system as required by Renewable Operating Permit

1.3.1. *Standard Units*

Unless specified differently within the text or notes, the following units are used throughout this document and in the automation system:

Variable	Unit
Area	ft ²
Energy	BTU
Energy Flux	BTU/hr.
Flow	gpm
Force	lb _r
Frequency	Hz
Linear	ft
Pressure (absolute)	psia
Pressure	psi or psig
Temperature (absolute)	°R
Temperature	°F
Time	seconds
Velocity	ft/sec
Volume (gas)	ft ³
Volume (liquid)	US gallons

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2. EAST TREATMENT BUILDING SYSTEM

2.1. SYSTEM DESIGN

In compliance with 40 CFR 63 Subpart DD MDWTP's ETB is considered a permanent total enclosure and with an air pollution control system which consist of a baghouse dust collector, thermal oxidizer and caustic wet scrubber, in series. The thermal oxidizer is a thermal destruction system that has 95% reduction efficiency. The building is operated with only one door open at a time in order to ensure natural draft openings satisfy the permanent total enclosure requirements and all o negative pressure to be maintained in the building.

2.2. SYSTEM DESCRIPTION

To meet the emission capture requirements of Subpart DD the airflow requirement for the ETB must be minimized and maintains a negative pressure in the ETB when a single truck door is open. The building was extended by 20 feet to allow all trucks to be contained within the building. The extra length is accommodating the movement of trucks forward when dumping large masses of material such as frozen loads. A set of high cycle doors minimizes the time the doors are open. Closing up the building is expected to cause high humidity and heat in the building. Water vapor is a by-product of the stabilization reaction. Up to 4,200 lbs. per hour of water vapor can be generated during the reaction process.

The supply duct will direct air away from the doors to contain tank emissions. A rear hood system operates in a push-pull arrangement.

The baghouse removes at least 99.4% of the dust in the air stream. Rotary valves will prevent the accumulation of dust within the baghouse. A variable speed fan is used to overcome the pressure drop in the duct, baghouse and mist eliminator.

Air passing thorough the baghouse is split between the recycle and thermal oxidizer circuits. The recycle circuit is used to control the atmosphere within the Treatment Building. The thermal oxidizer circuit uses a regenerative thermal oxidizer to destroy the VOC emissions. A regenerative thermal oxidizer was selected because it has low operating costs and a low exhaust temperature, which suits an acid scrubber. The thermal oxidizer (RTO) operates at greater than 1500 F to destroy 98% of the volatile organic content of the building exhaust. The thermal oxidizer's fan is sized for the acid scrubber and stack.

A quench system is fitted to the outlet of the thermal oxidizer to cool the thermal oxidizer. The quench system uses scrubber liquid for coolant. The rate of scrubber liquid injection is constant.

The acid scrubber is a packed column design. The liquid system recirculates caustic solution using a vertical pump to minimize seal and leak problems. The reagent will be a



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caustic solution, which will be metered into the caustic solution to maintain its pH. The caustic is transferred in a portable tote and pumped directly into the caustic tank, as needed.

Since 50% caustic solution freezes at about 60 F, all the reagent and spent caustic piping is heat traced and insulated. Tank heat is provided by an existing hot water boiler system. The scrubber is equipped with an immersion heater, which is activated during shutdowns to prevent freeze-ups.

The existing stack was modified to meet the needs of the thermal oxidizer system. For corrosion protection, the stack was lined with Carboline.

The thermal oxidizer system is controlled by a programmable logic controller system (PLC). In addition to maintaining each of the operating systems, the PLC also identifies system problems. The PLC uses a twostep system. For the first step, a message appears on the computer screen and a horn sounds for problems which need attention but do not immediately affect the operation of the system. In the second step, a message appears on the computer, a horn is sounded and a pager is dialed. These problems require immediate attention to keep the system operational. The system also has the capacity to be operated remotely. This allows engineers and technicians to remotely monitor or diagnose problems using a VPN.

2.3. LAYOUT

The exhaust hood system is located in the roof of the treatment building directly above the treatment tanks.. A supply duct is located near the building doors to move air back across the tanks. A single duct branches at the baghouse to utilize both baghouse cells. A single duct connects the baghouse to the thermal oxidizer.

A structural steel equipment platform is located between the baghouse and stack. This location utilizes space already occupied by the Air Pollution Control System (APCS) and therefore does not take away from space, which is used for other purposes. This location also provides short duct and electrical runs, which reduce capital and operating expenses. Lastly, this location does not severely impact our drum operations. The structure will be open to the weather. Below the platform, a prefabricated combination motor control center and central control room is located. All large motor starters and disconnects are located in the motor control center. The thermal oxidizer is located on the first floor. The acid scrubber is located next to the existing stack. The caustic and brine storage tanks are located in the existing tank farm.

2.4. CONTROLS

Michigan Disposal has installed a PLC selected because of 1) integrated programming and graphics, 2) intuitive logic which allows the program to be easily understood by management and maintenance personnel and 3) inexpensive components.



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The East Thermal Oxidizer System and West Baghouse are controlled by a single PLC that links and coordinates the various system components. It also utilizes a single system supervisory control, visual graphics, system alarming and data collection. Operations and maintenance personnel control and review system information from a single software program. The RTO has its own PLC that shares information with using a simple data sharing utility native the PLC. In addition to controlling the RTO, the PLC identifies any system problems. Problems, which do not immediately impact system operation, are displayed on the computer monitor. Problems, which could have an immediate impact on the system, are displayed on the computer monitor, an alarm indicating beacon is illuminated and personnel are notified. The system utilizes a VPN to allow for remote system troubleshooting/maintenance as needed.

In addition to the software program, the system utilizes a six channel electronic chart recorder which is used for compliance monitoring. The recorder records thermal oxidizer combustion chamber temperature and air flowrate among other parameters.

3. CONTACT LIST

Michigan Disposal maintains a contact list of supervisory personal, compliance support, system operators, primary and secondary support, and engineering and technical support at the plant. This list is available upon request.

4. VENDOR LIST

Vendor contacts are maintained by Michigan Disposal for the control equipment and instrumentation.

5. SEQUENCE OF OPERATIONS

5.1. WEST BAGHOUSE

5.1.1. Overview

The West Baghouse draws dust from the West Containment Building and routes through the West Baghouse by way of a suction fan/blower located downstream of the baghouse. Air is exhausted to atmosphere through a vertical stack. The Baghouse is comprised of dust bags, each with a dedicated pulse jet for cleaning purposes. Dust that falls from the bags is collected in four dust bins located immediately below the dust collectors. Each dust bin uses a local rotary valve to allow dust to dump into collection containers.

5.1.2. Cleaning

Dust cleaning can be initiated automatically when the baghouse DP is above a given set point as set on the Set Point screen or manually from the West Baghouse supervisory control screen. When activated in auto, the baghouse will continue to pulse each bag solenoid valve at the "On Duration" in mSec and "Off Duration" in Sec as set on the Set Point screen. Cleaning will continue until the baghouse dP drops below the "Stop



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Cleaning” set point set on the Set Point screen. In addition, there is timer that triggers an alarm when exceeded. No action is taken other than an alarm notification.

5.1.3. Starting (WBH Fan)

The West Baghouse (WBH) Fan can be started/controlled locally at a dedicated control panel. The Fan can also be placed under PLC control. When under PLC control, the fan can be started and run in an auto mode It can be also be started/run in a PLC Manual mode providing the operator with direct speed control of the fan.

The West Baghouse Fan can be run in the following modes:

- Locally at a dedicated control panel. The Control panel is located outdoors adjacent to the fan.
- Remotely from the PLC screen in any of the following modes:
 - Full Automatic Mode. Under this mode, the WBH Fan is started as part of the WTB startup by clicking on the WBH Start button on the top left corner of the Main Screen. During automatic operations all WBH related instrumentation are monitored and alarmed if out of tolerance and if warranted, the PLC will shutdown the WBH system. The PLC insures the fan operates at the correct air flow rate to maintain air pollution compliance.
 - Manually from the WBH screen. Clicking on the WBH Fan B-608 icon from the WBH screen will allow control of the fan. When running manually from the control screen, none of the systems associated with the WBH, such as dP’s for cleaning, are checked for alarms.

5.1.4. Auto Mode

The West Baghouse is started from the Main Screen by clicking on the button “Start WBH”. While under PLC control and in Auto Mode, fan speed is controlled by a PLC PID loop algorithm that monitors fan air flow in units of Standard Cubic Feet per Minute (SCFM) and adjusts the speed command to the fan to achieve the targeted air flow as set on the Set Point screen.

5.1.5. Compliance Monitoring

A running five (5) minute average of fan air flow in SCFM is maintained and monitored to ensure that air pollution compliance level of 80,000 SCFM is always exceeded. A running 5 minute average of Baghouse DP is also monitored and tracked to ensure DP falls between the High-High and Low-Low DP levels set for the baghouse on the Set Point screen. The control screen features a trend display titled “WBH Compliance” that shows a 1 (one) day trend with High-High and Low-Low limits for both Air Flow and DP 5 minute moving averages. When any compliance level is exceeded, an alarm is activated, the outdoor West Red Beacon is illuminated and a Win911 Call-Out is initiated.

5.1.6. Starting Permissives

While in auto mode, the following starting permissives must be satisfied to allow the fan to start.

- No “Failed to Start” or “Failed to Stop” alarms
- No VFD Drive Faults
- No previous/active “Start Current High-High” alarm
- No previous/active “Running Current High-High” alarm
- VFD is not in local mode. It must be in Remote.



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- No previous/active TE-608A Belt End Bearing Temp High-High alarm
- No previous/active TE-608B Fan End Bearing Temp High-High alarm
- No previous/active TE-607 Duct Temp High-High alarm
- No previous/active TE-608 VFD Cabinet High-High alarm

5.1.7. Running Permissives

While in auto mode, the following running permissives must be satisfied to allow the fan to continue running.

- No VFD Drive Faults
- No "Running Current High-High" alarm
- No TE-608A Belt End Bearing Temp High-High alarm
- No TE-608B Fan End Bearing Temp High-High alarm
- No TE-607 Duct Temp High-High alarm
- No TE-608 VFD Cabinet High-High alarm
- No WTB Compressed Air Low-Low alarm (Note: this has been temporarily bypassed at USEM's request)

5.1.8. Warnings

While in auto mode, the following events will generate WBH warnings.

- Running Current High
- Running Current Low
- VFD in Manual at HIM
- TE-608A Belt End Bearing Temp High
- TE-608B Fan End Bearing Temp High
- TE-607 Duct Temp High
- TE-608 VFD Cabinet High
- WTB Compressed Air Low

5.1.9. Alarms

While in auto mode, the following events will generate WBH Alarms. Typically these alarms must be active over 10 seconds.

- WBH dP PDT-606 High-High, High, Low, Low-Low
- WBH Air Flow via PDT-607 Five Minute Average High-High, High, Low, Low-Low
- WBH Fan Current I-606 High-High, High, Low, Low-Low
- WBH Fan Current I-606 Sensor Failed
- WBH Act Speed (Hz) ST-608 High-High, High, Low, Low-Low
- WBH Compressed Air PT-609 High-High, High, Low, Low-Low
- WBH VFD Cabinet Temperature TE-608 High-High, High, Low, Low-Low
- WBH VFD Cabinet Temperature TE-608 Sensor Failure
- WBH Air Duct TE-607 High-High, High, Low, Low-Low
- WBH Air Duct TE-607 Sensor Failure
- WBH Air Compressor Room Temp TE-609 High-High, High, Low, Low-Low
- WBH Fan B-608 YA-608 VFD Fault
- WBH Rotary Valve RV-100A Starter Fault
- WBH Rotary Valve RV-100B Starter Fault
- WBH Rotary Valve RV-100C Starter Fault
- WBH Rotary Valve RV-100D Starter Fault



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5.1.10. Compliance Alarms

While in auto mode, the following events will generate WBH Compliance Alarms. Compliance alarms will not shutdown the system but will initiate a Win911 Call-Out.

- WBH dP PDT-606 Out of Compliance High-High or Low-Low
- WBH SCFM Air Flow Five Minute Average Low or Low-Low

5.1.11. Win911 Call-out Alarms

While in auto mode, the following events will generate a Win911 Call-out.

- WBH dP PDT-606 Out of Compliance High-High or Low-Low
- WBH SCFM Air Flow Five Minute Average Low-Low

5.1.12. Alarm Beacon Illumination Events

While in auto mode, the following events will illuminate the WTB Red Alarm Beacon.

- WBH Out of Compliance Alarm
- WBH Shutdown Alarm
- WBH Not Running

5.2. EAST TREATMENT BUILDING SEQUENCE OF OPERATIONS

The ETB is comprised of the following systems

- Scrubber
- RTO
- East Baghouse

Of these three systems, only the Scrubber and East Baghouse can be run "Manually", typically for testing purposes.

The ETB is started from the Main Screen by clicking on the button "Start East Side RTO System". Initially the Scrubber is started. Once the Scrubber Pump P208 flowrate is above 150 GPM, the RTO is commanded to start. The RTO will cycle through a four minute purge cycle, and then begin heating up. Once RTO Combustion Temps TE-303 and TE-304 are both above 1600 DegF, the East Baghouse Fan is commanded to start.

5.3. SCRUBBER

5.3.1. Overview

The RTO utilizes an acid scrubber configured in a packed column design. Its dimensions are 8 feet in diameter and 24 feet in height. The liquid system recirculates up to 300 GPM of 2% caustic solution using a vertical pump to minimize seal and leak problems. The reagent will be 25% caustic solution, which will be metered into the caustic solution to maintain its pH. Water is added to make up for water lost to evaporation and the heat of reaction. Water loss from the scrubber is minimized by the use of a mist eliminator located above the packing. Since 50% caustic solution freezes at about 60 F, all the reagent and spent caustic piping is heat traced and insulated. Tank heat is provided by an existing hot water boiler system. The scrubber itself is equipped with an immersion heater, which is activated during shutdowns to prevent freeze-ups.

A quench system is fitted to the outlet of the thermal oxidizer to cool the thermal oxidizer exhaust to 115 F which is a good temperature for the acid scrubber. The quench system



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uses scrubber liquid for coolant with the rate of scrubber liquid injection being constant.

5.3.2. Starting

The Scrubber Pump can be run in the following modes:

- Locally at the ABB VFD
- Remotely from the PLC screen in any of the following modes:
 - Full Automatic Mode. Under this mode, the Scrubber is started as part of the ETB RTO Startup. During Automatic operations all Scrubber related instrumentation is monitored and alarmed if out of tolerance and if warranted, the PLC will shutdown the Scrubber system. Anytime the Scrubber is shutdown while in automatic mode, the RTO and EBH Fan are stopped too.
 - Manually from the screen. Clicking on the Scrubber Pump P-208 from the Scrubber screen will allow control of the pump. When running manually from the screen, none of the systems associated with the Scrubber are checked for alarms. i.e.; LT-208 level is not checked.
 - Manually running the Scrubber and its associated systems from the Scrubber screen. The operator can select the “Start Scrubber System Manually” button on the Scrubber screen. This button is not visible when the system is running or when running in automatic mode. During manual running, all of the native system checks and alarms for the Scrubber are active. For example, sump levels, pH levels, etc... are maintained and alarmed if out of tolerance. As this mode is reserved for system checking/debugging, the Scrubber will not shutdown due to low pH or FIT-208 compliance levels while in manual.

Whether running manually from the Scrubber screen or automatically, the Scrubber start permissives are checked and if good, the scrubber pump is started.

5.3.3. Auto Mode

The ETB is started from the Main Screen by clicking on the button “Start East Side RTO System” which initially starts the scrubber in an automatic mode as part of the start side startup. Pump speed is controlled by a PLC PID loop algorithm that monitors scrubber flow rate in units of Gallons per Minute (GPM) and adjusts the speed command to the pump to achieve the targeted flow rate as set on the Set Point screen.

When running in auto, the pH of the caustic is constantly monitored and when the realtime pH level is below a pH of 8.0, fresh caustic is added to the solution. As the pH rises, caustic add is disabled when pH reaches 8.2. During the caustic add, a 5 minute timer is started and if pH has not increased, an “AIT207A pH No Change” alarm will be initiated. No other action is taken.

The temperature of the inlet to the scrubber as measured by TE-204 is monitored and when it exceeds the Quench On high set point as set in the Set Point screen, the scrubber quench water valve SV-300 is opened along with the compressed air valve SV-301. The water/air mixture is injected into the quencher Q-204 housing cooling the RTO exhaust gasses. The quench water is shutoff 30 seconds after the TE-204 drops to the Quench Off SP as set in the Set Point screen.

The level of the Deaeration Tank T-208 is monitored by the PLC when the Scrubber is running. Thirty (30) seconds after the level drops below the DA Tank Fill Set Point as set



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in the Set Point Screen, the DA tank make up water valve XV-207B is opened allowing fresh water to enter the Quencher and work its way down to the Scrubber sump and DA Tank which are both hydraulically at the same level. XV-207B is closed as soon as the DA Tank level reaches the DA Tank Stop Fill Set Point as set in the Set Point Screen.

For both the Quench Cool and Scrubber DA Tank fill operations, the water flowrate as measured by flow indicating meter FIT-207B is monitored to ensure there is flow when called for. If a "No-Flow" condition is sensed, an alarm is identified. No other action is taken.

The Scrubber logic also monitors the Caustic Injection temperature as measured by TE-513. This equipment is protected by Heat Trace Ckt No. 8. Set Point Screen, Heat Trace Ckt No. 8 is energized heating the equipment. When the temperature rises above the Heat Track "OFF" Set Point temp as set on the Set Point screen, the circuit is de-energized.

5.3.4. Compliance Monitoring

A running five (5) minute average of Scrubber flow in GPM is maintained and monitored to ensure that the High-High compliance level of 300 GPM and Low-Low compliance level of 225 GPM are not exceeded. A running 5 minute average of caustic pH is also monitored and tracked to ensure the pH remains above a Low-Low pH level of 7.2 as set on the Set Point screen. (High-High pH is only alarmed) The features a trend display titled "Scrubber Compliance" that shows a 1 (one) day trend with High-High and Low-Low limits for both Scrubber flow and pH 5 minute moving averages. When any compliance level is exceeded, a alarm is activated, the outdoor East Red Beacon is illuminated and a Win911 Call-Out is initiated.

5.3.5. Starting Permissives

For automatic operation, the Scrubber is commanded to initially start before the RTO or EBH. When commanded to start in an auto or manual mode, these permissives must be satisfied. The Scrubber start permissives are as follows:

- LT-211 not Low-Low
- TE-502 Wet Room Temp not Low-Low
- TE-501 Control Room Temp not Low-Low
- TE-514 East Electrical Room Temp not Low-Low
- No VFD-P208 Prevent Start Alarm
- Scrubber Pump Seal Switch OK
- VFD_P208 in Auto at HIM
- No FIT207 No-Flow Alarm
- No LT-208 DA Tank Level Low Alarm
- PT-90 Water Pressure Not Low-Low
- PT302 ETB Compressed Air Pressure not Low-Low
- TE-207 Sump Temp not Low-Low

Once started, the following run permissives are checked.

5.3.6. Running Permissives

While in auto mode, the following running permissives must be satisfied to allow the Scrubber to continue running.



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- No VFD-P208 Fault Alarm
- Scrubber Pump Seal Switch OK
- No VFD_P208 High-High Starting Current
- No VFD_P208 High-High Running Current
- No VFD_P208 Low Running Current
- No FIT-208 5 minute average High-High for longer than 10 minutes
- AIT-207A pH *not* out of compliance for longer than 10 seconds
- LT-208 DA Tank Level not Low-Low (Level Switch or Level Transmitter).
- No Scrubber Sump Low Switch Alarm.
- PT-90 Water Pressure Not Low-Low.
- No AIT-207A Scrubber pH High-High over 10 minutes

5.3.7. Win911 Warnings

While in auto mode, the following events will generate a Scrubber Win911 warning.

- FIT208 Scrubber Flow GPM Low Alarm
- AIT-207A pH No-Change Alarm
- AIT-207A Scrubber pH High Alarm
- AIT-207A Scrubber pH Low Alarm

5.3.8. Alarms

While in auto mode, the following events will generate Scrubber Alarms. Typically these alarms must be active over 10 seconds.

- FIT208 Scrubber Flow GPM Low Alarm
- AIT-207A Scrubber pH High-High Alarm (Not compliance High-High)
- AIT-207A Scrubber pH High Alarm
- AIT-207A Scrubber pH Low Alarm
- AIT-207A Scrubber pH Low-Low Alarm (Not compliance Low-Low)
- DATank Level LT-208 High-High Alarm
- DATank Level LT-208 High Alarm
- DATank Level LT-208 Low Alarm
- DATank Level LT-208 Low-Low Alarm
- Scrubber Sump Low Switch Alarm
- Caustic Day Tank T-211 High-High Level Alarm
- Caustic Day Tank T-211 High Level Alarm
- Caustic Day Tank T-211 Low Level Alarm
- Caustic Day Tank T-211 Low-Low Level Alarm
- TE-502 Low Low Temp over 8 hours Alarm
- Caustic Pump High Pressure Switch PSH-111 Alarm

5.3.9. Compliance Alarms

While in auto mode, the following events will generate Scrubber Compliance Alarms. Compliance alarms will not shutdown the system but will initiate a Win911 Call-Out.

- Scrubber Flow FIT208 GPM 5 Minute Average Compliance High-High Alarm
- Scrubber Flow FIT208 GPM 5 Minute Average Compliance Low-Low Alarm
- Scrubber pH AIT207A 5 Minute Average Compliance Low-Low Alarm

5.3.10. Win911 Call-out Alarms

While in auto mode, the following events will generate a Win911 Call-out.



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- Scrubber Flow FIT208 GPM 5 Minute Average Compliance High-High Alarm
- Scrubber Flow FIT208 GPM 5 Minute Average Compliance Low-Low Alarm
- Scrubber pH AIT207A 5 Minute Average Compliance Low-Low Alarm

5.3.11. Scrubber Alarm Beacon Illumination Events

While in auto mode, the following events will illuminate the WTB Red Alarm Beacon.

- Scrubber Out of Compliance Alarm on FIT208 GPM 5 Minute Average High-High or Low-Low or AIT207A pH Low-Low.
- Scrubber Shutdown Alarm
- Scrubber Not Running

5.4. RTO

5.4.1. Overview

Air passing thorough the baghouse is split between the recycle and thermal oxidizer circuits. The recycle circuit is used to control the atmosphere within the Containment/Treatment Building. The thermal oxidizer circuit uses a regenerative thermal oxidizer to destroy the VOC emissions. A regenerative thermal oxidizer was selected because it has low operating costs and a low exhaust temperature, which suits an acid scrubber. The thermal oxidizer (RTO) operates at greater than 1500 F to destroy 98% of the volatile organic content of the building exhaust. The thermal oxidizer's fan is sized for the acid scrubber and stack.

The thermal oxidizer system is controlled by a programmable logic controller system (PLC). In addition to maintaining each of the operating systems, the PLC also identifies system problems. The PLC uses a two-step system. RTO Operations, Starting and Run Permissives are constantly monitored and alarmed to ensure safe operations. General alarms are identified and more critical alarms, such as compliance alarms, will trigger an alarm call-out on the Win911 sytem. Severe alarms will trigger an immediate shutdown of the ETB systems including the RTO, the Scrubber and the EBH Fan.

5.4.2. Starting

The RTO can only be started as part of the start procedure for the ETB. Under no circumstances can it be run individually without the Scrubber and East Baghouse Fan. The RTO is started from the Main Screen by clicking on the button "Start East Side RTO System". As long as the RTO Start Permissives are satisfied, the Scrubber will start in an automatic mode followed by the RTO initiating a four (4) minute purge cycle only when the Scrubber Pump flowrate is above 150 GPM.

5.4.3. Auto Mode

As mentioned above the RTO will enter a four (4) minute purge cycle once the Scrubber Pump flowrate is above 150 GPM. The Scrubber flow rate must remain above the 150 GPM rate in order to proceed.

Once the purge cycle is complete, natural gas is injected directly into the RTO via SDV-300 and SDV_302 opening. Every 4 minutes the air path through the RTO reverses allowing for an even distribution of hot air. The RTO will continue to heat up until both chamber temperature sensors TE-303 and TE-304 read above 1600 DegF. At that point, the EBH Fan B-104 is started and will ramp up to it's set point speed as set in the Set Point Screen. Natural Gas valve SDV-302 will close and NGI Gas Injection valve SDV-



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303 will open allowing gas to enter the process air flow path directly in front of Process Fan B-201. RTO temperatures will be regulated by the opening and closing of SDV-300. The current gas temperature set point that is directly programmed into the RTO SLC PLC is 1,650 DegF. When below 1,650 SDV-300 is opened, when above, it is opened.

To maintain the RTO Airflow compliance set point, two PID loops manage airflow through the RTO. The EBH Fan Speed is controlled based on an air flow set point set in the Set Point screen and measured by FT-104. While the EBH PID loop is controlling to this air flow SP, a second PID loop is controlling the Make-Up Air Flow via measuring airflow through the RTO via FT-201A and modulating the butterfly valve FV-107 in the Make-Up air duct to meet the RTO Air Flow SP as set in the Set Point screen.

5.4.4. Compliance Monitoring

A running five (5) minute average of fan air flow in SCFM is maintained and monitored to ensure that air pollution compliance level of 80,000 SCFM is always exceeded. A running 5 minute average of Baghouse DP is also monitored and tracked to ensure DP falls between the High-High and Low-Low DP levels set for the baghouse on the Set Point screen. The display features a trend display titled "WBH Compliance" that shows a 1 (one) day trend with High-High and Low-Low limits for both Air Flow and DP 5 minute moving averages. When any compliance level is exceeded, an alarm is activated, the outdoor West Red Beacon is illuminated and a Win911 Call-Out is initiated.

5.4.5. Starting Permissives

5.4.5.1. RTO SLC Generated

- PSL-304 Low Fuel Pressure Switch OK
- PSH-302 High Fuel Pressure Switch OK
- PSL-305 Low Comb Air Pressure Switch OK
- All RTO Hardware Permissives Met (Relay Permissive Logic)
- No RTO E-Stop
- No Low Compressed Air Pressure Alarm
- No Low Process Air Pressure Alarm
- No Low Bed DP Alarm
- No TE-305 Exhaust Temp Low Alarm
- No Low Fuel Pressure Alarm
- No B-201 Failed To Run Alarm
- No Average Chamber Temp TE-303/304 High Alarm
- No TE-301 Inlet Temp Low Alarm
- No Combustion Air Motor Low Air Pressure Alarm
- No Combustion Air Motor Failed to Run Alarm
- No Combustion Air Blocking Valve Not Closed Alarm
- No Average or Individual Chamber Temp TE-303,TE-304 High Alarm
- No TE301 Inlet Temp High High Alarm
- No All External Permissives NOT MET or Hardware Fault Alarm
- No Burner Fault



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5.4.5.2. Software Generated

- No TE-501 Control Room Low Low Temp Alarm
- No East MCC Room Low Low Temp Alarm TE-514
- No VFD P208 Prevent Start Alarm
- No LT-208 DATank Level Low Alarm
- No PT-90 System Water Pressure Low Low Alarm
- No ETB Air Compressor PT302 Low-Low ALARM
- Scrubber Start Permissives OK
- No UV104 Failed to Close Alarm

5.4.6. Running Permissives

5.4.6.1. RTO SLC Generated

- PSL-304 Low Fuel Pressure Switch OK
- PSH-302 High Fuel Pressure Switch OK
- All RTO Hardware Permissives Met (Relay Permissive Logic)
- No RTO E-Stop
- No General RTO Fault
- No TE-305 Exhaust Temp Low Alarm
- No Low Fuel Pressure Alarm
- All External Run Permissives Met
- No Burner Fault

5.4.6.2. Software Generated

- No RTO Bearing TE201A High-High Temp Alarm
- No RTO Bearing TE201B High-High Temp Alarm
- No General RTO Fault or Shutdown from RTO SLC O:2/15
- No RTO dP Related Shutdown
- No Scrubber Pump P-208 VFD Run Current Low Alarm
- No Scrubber Pump P-208 VFD Fault
- No Scrubber Stop Alarms
- Scrubber Running Permissives OK
- No ETB Air Compressor PT302 Low-Low ALARM
- No UV104 Failed to Close Alarm

5.4.7. Win911 Warnings

While in auto mode, the following events will generate an RTO Win-911 warning alarm.

- RTO Air Flow FE-201A High-High Alarm
- RTO Air Flow FE-201A Low Alarm
- RTO Combustor 5-Min Avg High Alarm
- RTO Combustor 5-Min Avg Low Alarm

5.4.8. Alarms

While in auto mode, the following events will generate RTO Alarms. Typically these alarms must be active over 10 seconds.

- RTO Combustor 5-Min Avg High-High Alarm
- RTO Combustor 5-Min Avg High Alarm



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- RTO Combustor 5-Min Avg Low Alarm
- RTO Combustor 5-Min Avg Low-Low Alarm (Non Compliance Low-Low)
- RTO Fan B-201 Bearing Temp TE-201A High-High Alarm
- RTO Fan B-201 Bearing Temp TE-201A High Alarm
- RTO Fan B-201 Bearing Temp TE-201A Bad T/C Alarm
- RTO Fan B-201 Bearing Temp TE-201B High-High Alarm
- RTO Fan B-201 Bearing Temp TE-201B High Alarm
- RTO Fan B-201 Bearing Temp TE-201B Bad T/C Alarm
- PT-303 Natural Gas Pressure High-High Alarm
- PT-303 Natural Gas Pressure High Alarm
- PT-303 Natural Gas Pressure Low Alarm
- PT-303 Natural Gas Pressure Low-Low Alarm
- RTO Air Flow FE-201A High-High Alarm
- RTO Air Flow FE-201A High Alarm
- RTO Air Flow FE-201A Low Alarm
- (RTO dP - Bed dP) > 5 In Water Alarm
- PT-90 System Water Pressure High-High Alarm
- PT-90 System Water Pressure High Alarm
- PT-90 System Water Pressure Low Alarm
- PT-90 System Water Pressure Low-Low Alarm
- TE-505 Boiler Circulation Loop Temp High-High Alarm
- TE-505 Boiler Circulation Loop Temp High Alarm
- TE-505 Boiler Circulation Loop Temp Low Alarm
- TE-505 Boiler Circulation Loop Temp Low-Low Alarm
- East MCC Room Temperature TE-514 High-High Alarm
- East MCC Room Temperature TE-514 High Alarm
- East MCC Room Temperature TE-514 Low Alarm
- East MCC Room Temperature TE-514 Low-Low Alarm
- Control Room Temperature TE-501 High-High Alarm
- Control Room Temperature TE-501 High Alarm
- Control Room Temperature TE-501 Low Alarm
- Control Room Temperature TE-501 Low-Low Alarm

5.4.9. Compliance Alarms

While in auto mode, the following events will generate RTO Compliance Alarms.

- Out of Compliance High-High or Low-Low

5.4.10. Win911 Call-out Alarms


While in auto mode, the following events will generate a Win911 Call-out.

- RTO Combustor 5-Min Avg High-High Alarm
- FE-201 RTO Air Flow Compliance Low-Low Alarm
- RTO Combustor Compliance Low-Low Alarm

5.4.11. RTO Alarm Beacon Illumination Events

While in auto mode, the following events will illuminate the ETB Red Alarm Beacon.

- RTO Combustor 5-Min Avg High-High Alarm
- RTO Shutdown Alarm

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- RTO Not Running

5.5. EAST BAGHOUSE

5.5.1. Overview

The East Baghouse draws dust from the East Containment Building and routes through the East Baghouse by way of a suction fan/blower B-104 located downstream of the baghouse itself. A portion of the fan exhaust is recirculated back to the Containment Building via the Make Up Air Valve FV-107. Air is exhausted to either the RTO (Normal Operation) or to atmosphere via butterfly valve UV-104A. The Baghouse itself is comprised of 9 bags each with a dedicated pulse jet for cleaning purposes. Dust that falls from the bags is collected in two dust bins located immediately below the dust collectors. Each dust bin uses a local rotary valve to allow dust to dump into two portable totes for disposal back into the containment building.

5.5.2. Cleaning

Dust cleaning can be initiated automatically when the baghouse DP is above a given set point as set on the Set Point screen or manually from the East Baghouse screen. When activated in auto, the baghouse will continue to pulse each bag solenoid valve at the "On Duration" in mSec and "Off Duration" in Sec as set on the Set Point screen. Cleaning will continue until the baghouse dP drops below the "Stop Cleaning" set point set on the Set Point screen. In addition, there is timer that triggers an alarm when exceeded. No action is taken other than an alarm notification.

5.5.3. Starting (EBH Fan)

The East baghouse can be started/controlled locally in the control room or placed under PLC control. When under PLC control, the fan can be run in an auto mode where the PLC monitors all related instrumentation to ensure the fan operates at the correct air flow rate to maintain air pollution compliance while protecting the fan from system failures such as high bearing temperatures. It can be also be run in a PLC Manual mode providing the operator with direct speed control of the fan at the EBH screen.

5.5.4. Auto Mode

While under PLC control and in Auto Mode, fan speed is controlled by a PLC PID loop algorithm that monitors fan air flow in units of Standard Cubic Feet per Minute (SCFM) and adjusts the speed command to the fan to achieve the targeted air flow as set on the Set Point screen.

5.5.5. Compliance Monitoring

A running five (5) minute average of fan air flow in SCFM is maintained and monitored. A running 5 minute average of Baghouse dP is also monitored and tracked to ensure dP falls between the High-High and Low-Low dP levels set for the baghouse on the Set Point screen to ensure that air pollution compliance levels are always maintained. The features a trend display titled "EBH Compliance" that shows a 1 (one) day trend with High-High and Low-Low limits for both Air Flow and DP 5 minute moving averages. When any compliance level is exceeded, an alarm is activated, the outdoor ETB Red Beacon is illuminated and a Win911 Call-Out is initiated.

5.5.6. Starting Permissives

While in auto mode, the following starting permissives must be satisfied to allow the fan to start.



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- No "Failed to Start" or "Failed to Stop" alarms
- No VFD Drive Faults
- No previous/active "Start Current High-High" alarm
- No previous/active "Running Current High-High" alarm
- VFD is not in local mode. It must be in Remote.
- No previous/active TE-104A Belt End Bearing Temp High-High alarm
- No previous/active TE-104B Fan End Bearing Temp High-High alarm
- No previous/active TE-104C Duct/Process Air Temp High-High alarm

5.5.7. Running Permissives

While in auto mode, the following running permissives must be satisfied to allow the fan to continue running.

- No VFD Drive Faults
- No "Running Current High-High" alarm
- No TE-104A Belt End Bearing Temp High-High alarm
- No TE-104B Fan End Bearing Temp High-High alarm
- No TE-104C Duct Temp High-High alarm
- No TE-608 VFD Cabinet High-High alarm
- No ETB Compressed Air PT-302 Low-Low alarm (Note: this has been temporarily bypassed at USEM's request)

5.5.8. Warnings


While in auto mode, the following events will generate EBH warnings.

- Running Current High
- Running Current Low
- VFD in Manual at HIM
- TE-104A Belt End Bearing Temp High
- TE-104B Fan End Bearing Temp High
- TE-104C Duct Temp High
- PT-302 ETB Compressed Air Low

5.5.9. Alarms

While in auto mode, the following events will generate EBH Alarms. Typically these alarms must be active over 10 seconds.

- EBH dP PDT-101 High-High, High, Low, Low-Low
- EBH Fan Current I-104 High-High, High, Low, Low-Low
- EBH Fan Current I-104 Sensor Failed
- EBH Process Air Flow FE-104 High-High, High, Low, Low-Low
- EBH Act Speed (Hz) ST-104 High-High, High, Low, Low-Low
- EBH Compressed Air PT-302 High-High, High, Low, Low-Low
- EBH Air Duct TE-104C High-High, High, Low, Low-Low
- EBH Air Duct TE-104C Sensor Failure
- EBH Containment Building TE-100 High-High, High, Low, Low-Low
- EBH Fan B-104 YA-104 VFD Fault
- EBH Rotary Valve RV-101A Starter Fault
- EBH Rotary Valve RV-101B Starter Fault

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5.5.10. Compliance Alarms

While in auto mode, the following events will generate EBH Compliance Alarms. Compliance alarms will not shutdown the system but will initiate a Win911 Call-Out.

- EBH dP PDT-101 Out of Compliance High-High or Low-Low

5.5.11. Win911 Call-out Alarms

While in auto mode, the following events will generate a Win911 Call-out.

- EBH dP PDT-101 Out of Compliance High-High or Low-Low

5.5.12. EBH Alarm Beacon Illumination Events

While in auto mode, the following events will illuminate the ETB Red Alarm Beacon.

- EBH Out of Compliance Alarm
- EBH Shutdown Alarm
- EBH Not Running

6. SCADA SYSTEM

6.1. ROCKWELL AUTOMATION FACTORY TALK VIEW SE

6.1.1. The East and West Baghouse/RTO system utilizes Rockwell's Factory Talk View (FTV) SCADA package for Visualization, Alarming, Data Archiving, and as a data source for the Win911 Emergency Call-out package. The FTV package is Rev 8.1 Site Edition (SE) running as a local station

6.2. SCREENS

6.2.1. *The following screens comprise the visualization portion of the SCADA system.*





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6.2.2. Main

8/12/2016
2:41:21 PM

Main
 West Bag House
 East Bag House
 RTO
 Scrubber
 PID Loops
 Set Points
 Alarms
 Trends
 Maintenance
 Current User
Default

MAIN

RTO System Running

Stop East RTO System

EAST SIDE Fault Reset

WBH FAN B-608 IS RUNNING

STOP WBH

WEST SIDE Fault Reset

SYSTEM	OPERATIONAL STATUS	ALARM / WARNING STATUS	COMPLIANCE PARAMETERS	GENERAL STATUS	ALARM BEACON
WEST BAGHOUSE	RUNNING	NORMAL OPERATION - NO ALARMS	<div style="border: 1px solid black; padding: 2px; background-color: #f0f0f0;">3.5</div> <small>PDT-606 WBH dP 5Min Avg</small>	<div style="border: 1px solid black; padding: 2px; background-color: #f0f0f0;">83987</div> <small>FT-607 WBH SCFM 5Min Avg</small>	
EAST BAGHOUSE	RUNNING	NORMAL OPERATION - NO ALARMS	<div style="border: 1px solid black; padding: 2px; background-color: #f0f0f0;">3.1</div> <small>PDT-101 EBH dP 5Min Avg</small>	<div style="border: 1px solid black; padding: 2px; background-color: #f0f0f0;">32002</div> <small>FT-107 EBH SCFM 5Min Avg</small>	
RTO	RUNNING	NORMAL OPERATION - NO ALARMS	<div style="border: 1px solid black; padding: 2px; background-color: #f0f0f0;">1640</div> <small>COMB CHAMBER TEMP 5Min Avg</small>	<div style="border: 1px solid black; padding: 2px; background-color: #f0f0f0;">20492</div> <small>FT-201A RTO SCFM 5Min Avg</small>	
SCRUBBER	RUNNING	NORMAL OPERATION - NO ALARMS	<div style="border: 1px solid black; padding: 2px; background-color: #f0f0f0;">8.23</div> <small>AIT-207A pH 5Min Avg</small>	<div style="border: 1px solid black; padding: 2px; background-color: #f0f0f0;">245</div> <small>FIT-208 Scrub Flow 5Min Avg</small>	

TE-505 BOILER LOOP ALARMS DISABLED

93

TE-514
EAST ELECT ROOM TEMP

Test Win911 Bit 0

System DPT-301 12
Bed DPT-302 10
Difference 2

98

PT-302
EAST AIR COMP PRESS PSIA

88

PT-609
WEST AIR COMP PRESS PSIA

98

TE-100
CONTAN BLDG TEMP DEGF

69

TE-501
CONTROL RM ROOM TEMP

87

TE-502
WET ROOM TEMP DEGF

93

TE-503
AMBIENT TEMP DEGF

90

TE-504
PUMP ROOM TEMP DEGF

92

TE-505
TANK HEATING TEMP DEGF

81

TE-520
PLANT WATER CIRCUIT TEMP

82

TE-608
VFD CABINET TEMP DEGF

101

TE-609
WEST AIR COMP ROOM TEMP

HI SP 105



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6.2.3. West Bag House

8/12/2016
2:41:53 PM

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 West Bag House
 East Bag House
 RTO
 Scrubber
 PID Loops
 Set Points
 Alarms
 Trends
 Maintenance
 Current User Default

WEST BAGHOUSE

93 TE-503 OUTSIDE AMBIENT TEMP DEGF

82 TE-608 VFD CABINET TEMP DEGF

82 PT-609 WEST AIR COMP PRESS PSIA

WEST CONTAINMENT BUILDING

WBH FAN B-608 IS RUNNING

STOP WBH

West Baghouse Alarm Reset

3.5 PDT-606 WBH dP 5 MIN AVG
Start SP: 4.0
Stop SP: 3.5

3.6 PDT-606 WBH dP

PULSE JETS OFF
(CLEANING CYCLE STOPPED)

SV-601A
 SV-601B
 SV-601C
 SV-601D
 SV-601E

SV-601F
 SV-601G
 SV-601H
 SV-601I
 SV-601J

RV-100A

RV-100B

RV-100C

RV-100D

Pulse Jet Control

81 TE-607 DUCT TEMP DEGF

83999 FT-607 WBH SCFM 5 MIN AVG
PID SP: 84.0

83618 FT-607 WBH AIR FLOW SCFM

1.14 PDT-607 WBH AIR FLOW DP

AUTO

MOTOR RUNNING

WBH FAN B-608

MOTOR SPEED (HZ)	(%)
COMMANDED 54	83
ACTUAL 54	90

CURRENT I-608	214	AMPS
BE BRG TE-608A	87	DEGF
FE BRG TE-608B	86	DEGF

WBH Parameters Friday, August 12, 2016

Caption	2:41:53 PM	Min	Max	Units
PDT607 - WBH Air Flow	1.18	0.00	5.00	In H2O
PDT606 - WBH Baghouse dP	3.55	0.00	10.00	In H2O
B-608 - WBH Actual Speed	54.00	0.00	72.00	Hz
WBH SCFM 5 Min Average	84,001.43	0.00	100,000.00	SCFM
WBH Baghouse dP 5 Min Average	3.55	0.00	10.00	In H2O





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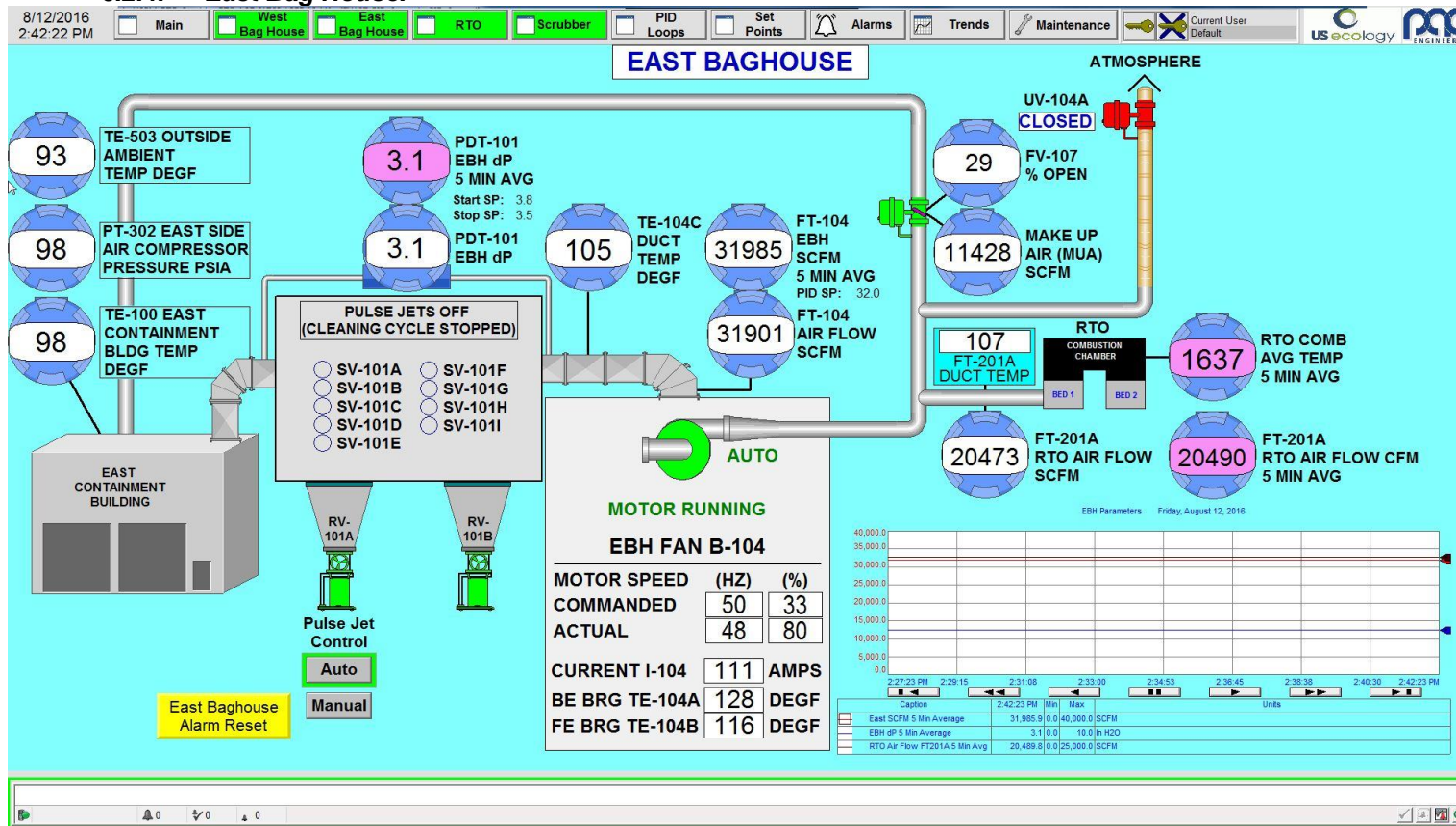
0

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6.2.4. East Bag House.





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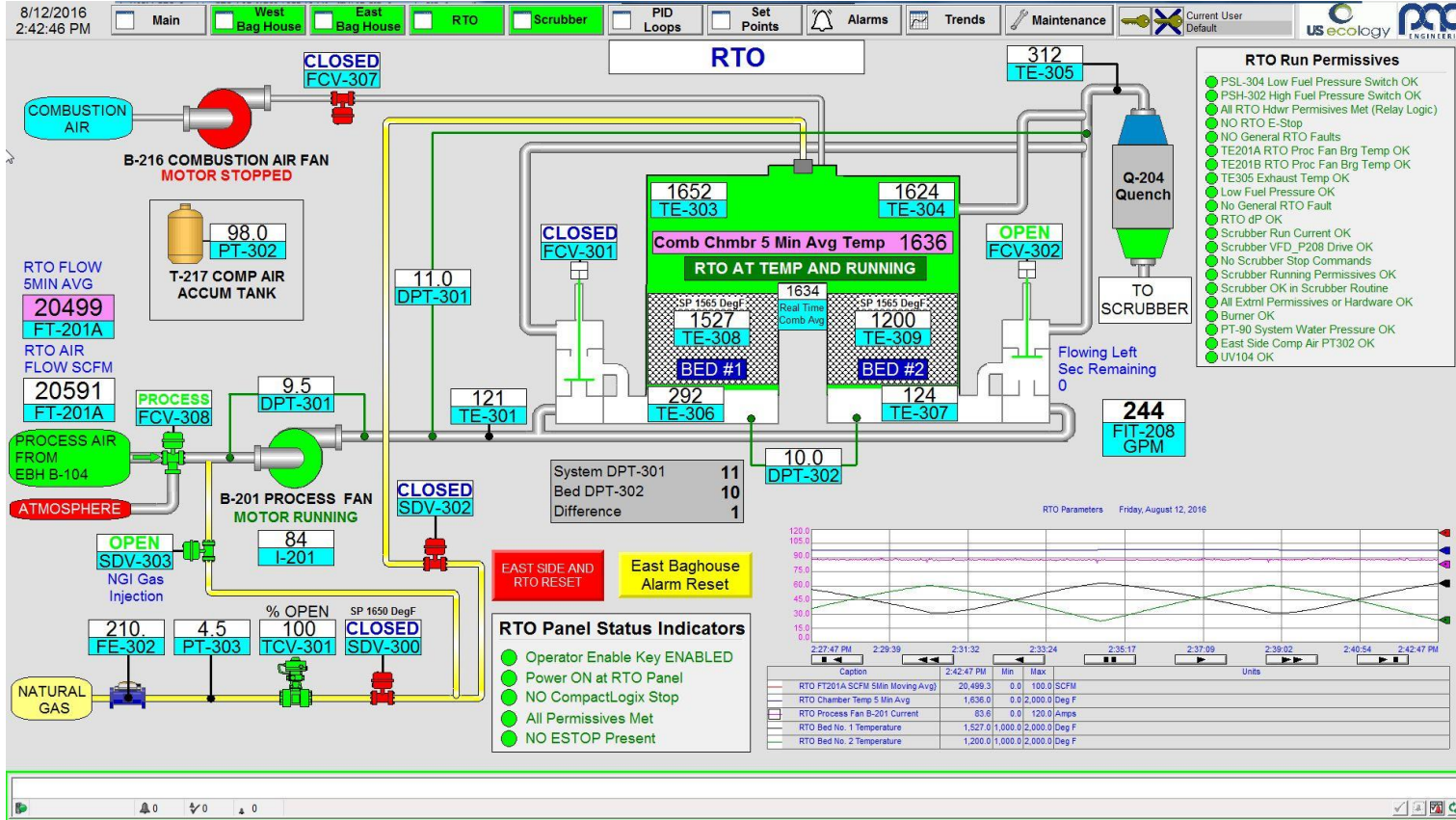
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6.2.5. RTO





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6.2.6. Scrubber

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2:43:09 PM

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 Scrubber
 PID Loops
 Set Points
 Alarms
 Trends
 Maintenance
 Current User Default

DPT-301 DP of RTO	11 W.C.
DPT-302 DP of Beds	-10 W.C.
RTO - BED dP	1 W.C.
FT-302 NG Flow	5072 SCFM
PT-301 Fan DP	9.0 W.C.
PT-302 Air Pressure	97 PSI
PT-303 Fuel Pressure	3.6 PSI
TE-301 Inlet Temp	120 F
TE-303 Comb Chmbr	1652 F
TE-304 Comb Chmbr	1622 F
TE-305 Exhaust Temp	253 F
TE-306 Bed 1 Inlet	189 F
TE-307 Bed 2 Inlet	129 F
TE-308 Bed #1 Temp	1523 F
TE-309 Bed #2 Temp	1216 F

Thermal Oxidizer		
RTO STATUS	AUX SYSTEM STATUS	PROCESS STATUS
No RTO Faults	CPLX PLC READY	OK
20412 FT-201A RTO Air Flow	20520 FT-201A 5 Min Avg	116 TE-201A Wheel End
1637 Chmbr Temp Avg Temp	1634 Chmbr Temp 5 Min Avg	103 TE-201B Drive End
88 I-201 Process Fan		

90 TE-504 Pump Room	93 TE-514 East MCC Rm
92 TE-505 Tank Heating	46 PT-90 Water Press
98 TE-100 Contamnt Bld	69 TE-501 Control Rm
87 TE-502 Wet Room	93 TE-503 Ambient

Caustic Day Tank T-211	LSH-211	4.3
Level Feet	LT-211	Level Feet

253 TE-305 RTO Exhaust	23 FIT-207B Scrub H2O
Q-204 Quench	SV-300 Quench Water
99 TE-204 Inlet Temp	104 TE-207 Sump Temp
246 FIT-208 GPM	245 FIT-208 5 Min Avg
6.9 I-208 AMPS	2.9 LT-208 FEET
8.35 AIT-207A pH	8.23 AIT-207A pH 5 Min Avg

Caption	2:43:09 PM	Min	Max	Units
RTO Air Flow FT-201A 5 Min Average	20,520.90	0.00	30,000.00	SCFM
Scrubber Pump P-208 5 Min Average	244.61	0.00	300.00	GPM
Scrubber Water pH 5 Min Average	8.23	0.00	14.00	pH
DA Tank LT-208 Level	2.87	0.00	5.00	Feet
Caustic Day Tank Level	4.34	0.00	5.00	Feet

K-207 Scrubber Run Permissives

- No VFD_P208 Fault Alarm
- No VFD_P208 Hi-Hi Start Current Alarm
- No VFD_P208 Hi-Hi Running Current Alarm
- No VFD_P208 Low Running Current Alarm
- TE-502 OK
- LT-208 DA Tank Level OK
- P-208 Pump Seal OK
- PT-90 System Water OK
- FIT-208 5-Min Compliance Avg Not Low-Low
- AIT-207A pH 5-Min Avg In Compliance

Press to CIP P-150 (60 Sec Purge with DA Tank) 60 Sec Remaining

Caustic Refill Tote

CAUSTIC PUMP PRESSURE SWITCH PSH-211

DA TANK T-208

East Baghouse Alarm Reset



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7. SPARE PARTS LIST

7.1. CRITICAL PARTS

Not all spare parts are maintained on-site. The lists presented below are for ease in accessing part numbers and/or vendors when needed. Vendor's may be updated as needed.

7.1.1. Thermal Oxidizer Fan

Item	Quantity	Part No.	Alt. Part No.	Vendor
Bearing	2	PLB 6847H-2 15/16	SAF 22517-C3	Motion Industries
Belts	5	5VX1400		Motion Industries
Thermocouple	1		J49005G-11C-16-23A036-012-CG	SW Controls
Flex Joint	1	CEJ-2262		Adwest

7.1.2. Baghouse Fan - ETB

Item	Quantity	Part No.	Alt. Part No.	Vendor
Bearing	2	PLB 6855H-3 7/16	SAF 22520 - C3	Motion Industries
Belts	5	5VX-1600		Motion Industries
Thermocouple	2		J49005G-11C-16-23A036-012-CG	SW Controls
Flex Joint – Inlet	1			HM White
Flex Joint - Outlet	1			HM White



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7.1.3. Baghouse Fan - WTB

Item	Quantity	Part No.	Alt. Part No.	Vendor
Bearing	2	140SLB22L-O-FP		Motion Industries
Belts	10			

7.1.4. Scrubber System

Item	Quantity	Part No.	Alt. Part No.	Vendor
Contactora	1	8910/DPA23		Square D
Impeller	1	FY00243B001D		Corrosion Fluid Products
Impeller O-Ring	1	FY70048C495		Corrosion Fluid Products
Shaft	1	FY006UBC01AH		Corrosion Fluid Products
Bearing Holder	1	FY01296B01P		Corrosion Fluid Products
Snap Ring	1	FY70023B03P		Corrosion Fluid Products
Ball Bearing	1	FY70020C07P		Corrosion Fluid Products
Slinger	1	FY04007B025		Corrosion Fluid Products
O-Ring	1	FY70048C475		Corrosion Fluid Products
O-Ring	1	FY70048C995		Corrosion Fluid Products
Sleeve Bearing	1	FY09358B001		Corrosion Fluid Products
Snap Ring	1	FY09357A001		Corrosion Fluid Products
Pin	1	FY50097A001		Corrosion Fluid Products
Manway Gasket	1	30" ANSI 125 lb., Neoprene		Harrison Pipe



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Item	Quantity	Part No.	Alt. Part No.	Vendor
Flange Gasket	2	4" ANSI 125 lb., 1/8" Neoprene		Harrison Pipe
Flange Gasket	3	1" ANSI 125 lb., Teflon		Harrison Pipe
Flange Gasket	3	1.5" ANSI 125 lb., Teflon		Harrison Pipe
Flange Gasket	1	2" ANSI 125 lb., 1/8" Neoprene		Harrison Pipe
Flange Gasket	1	3" ANSI 125 LB, Teflon		Harrison Pipe
Flange Gasket	1	Special		
Mist Eliminator	1	GR50036		
Pump Coupling	1	6JEMS		Motion Industries
Water Flush Solenoid Valve	1	8221G3		Harrison Pipe
Flow Switch	1	AT12-1620		SW Controls

7.1.5. Caustic Transfer/Scrubber Blowdown Pumps

Item	Quantity	Part No.	Alt. Part No.	Vendor
Pump Motor Heaters	3	CR123C184A		
CD Repair Kit	1	2205		Universal Pump
Seal	1	0492-P		Universal Pump

7.1.6. Condensate Pump

Item	Quantity	Part No.	Alt. Part No.	Vendor
O-Ring/Casing	2	7		Universal Pump





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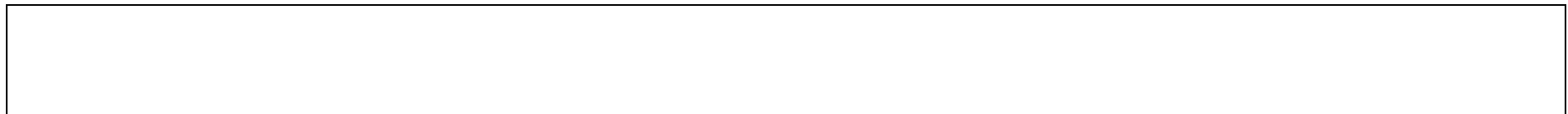
Impeller	1	11	Universal Pump
Seal Rotating Element	1	12	Universal Pump
Seal Stationary Seat	1	125	Universal Pump

7.1.7. Burner

Item	Quantity	Part No.	Alt. Part No.	Vendor
Spark Plug	1	17071		Industrial Burner Systems
Flame Rod	1	13093		Industrial Burner Systems
End Gasket	6	96510		Industrial Burner Systems
Gas Valve Seal Assembly	2	133392A		Pameco
Valve Actuator				

7.1.8. Thermal Oxidizer Unit

Item	Quantity	Part No.	Alt. Part No.	Vendor
Inlet/Exhaust Thermocouple	2	K-2		Adwest
Combustion Zone Thermocouple	2	K-18 7/16		Adwest
Panel Fuse Replacement Set	1	PFR-20		Adwest
See below for individual fuses				
Cylinder Rebuild Kit	2	RBK-6.0		Adwest
Cylinder Rebuild Kit	2		B732942	Schrader Bellows





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Item	Quantity	Part No.	Alt. Part No.	Vendor
Poppet Valve Cylinder	2	FW26122401 19.00 SHH36816 A		
Direction Valve Solenoid	1	SBL705		Adwest
Directional Valve Disc	2	CSVD-45		Adwest
Gas Shutdown Valve Actuator	1	HW-4055		Adwest
Gas Shutdown Valve Actuator	1		V4055A-1312	Pameco
Hi-Gas Pressure Switch	1	HW-H1001		Adwest
Hi Gas Pressure Switch	1		C437H-1001	Pameco
Lo-Gas Pressure Switch	1	HW-G1028		Adwest
Lo Gas Pressure Switch	1		C4376-1028	Pameco
Modulating Gas Actuator	1	HW-7200		Adwest
Modulating Gas Actuator	1	M-7284C 1000		Pameco
Gas Shutdown Valve - Solenoid Type	1	ASEFB-80		Adwest
Hi Limit Controller	1	HW-DC200H		Adwest
UV Scanner	1	HW-C7035		Adwest
UV Scanner	1		C7035A 1023	Pameco
Flame Safeguard Main Relay	1	HW-RM7895		Adwest
Flame Safeguard Main Relay	1		Rm7895a-1014	Pameco



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Item	Quantity	Part No.	Alt. Part No.	Vendor
Power Fuse	3	FRS-R-30	TRS 30R	
Power Fuse	3	FRS-R-17 ½	TRS 171/2	
Power Fuse	1	FRN-R-60	AJT60	
Power Fuse	2	FRS-R-15	TRS 15R	
Relay	1	700 HA32A1		McNaughton McKay
Relay	1	700 HA33A1		McNaughton McKay
Heater	1	AH 8001B		
Contactora	1	100-A18ND3		McNaughton McKay
Control Fuse	1	TRM1		
Control Fuse	1	TRM2		
Control Fuse	1	FNM-15		
Heater Fuse	1	FNM-8		
Control Panel Heater	1	D AH8001B		Madison Electric
Burner Mounting Gasket	1	20151		Mansfield Co
Spark Plug	1	10012		Mansfield Co
Peepsight	1	13225		Mansfield Co
Burner O-ring	2	14778		Mansfield Co
Orifice Plate	1	14188-5		Mansfield Co
Orifice Plate	1	20152-1		Mansfield Co
UV scanner adapter	1	10031		Mansfield Co
End Gasket	1	76510		Mansfield Co
Combustion, HV	1	100042		Mansfield Co





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Item	Quantity	Part No.	Alt. Part No.	Vendor
Burner Block & Holder	1	100016-68		Mansfield Co
Peep Sight	1	P-1030-8A		
Heat Resistant Tape	2	CES2262CS		
Input Card	1	1746-IA16		McNaughton McKay
Output Card	1	1746-OA16		McNaughton McKay
Thermocouple Card	1	1746-NT4		McNaughton McKay
Controller	1	1747-L541		McNaughton McKay

7.1.9. Silo Dust Collector

Item	Quantity	Part No.	Alt. Part No.	Vendor
Belt	2	4L360		Stephens Mfg
Bearing	1	PB 250-1		Stephens Mfg
Bearing	1	PB 250-1/2		Stephens Mfg
Rod End Bearing	2	TF 12 N		Stephens Mfg.
Bags	36	7" Dia X 72"		10.56 ft2 , Polyester

7.1.10. Baghouse

Item	Quantity	Part No.	Alt. Part No.	Vendor
Adjustable Vane				Burke Sales
Bearing				Burke Sales
Drive Chain				Burke Sales
Quad Rings				Burke Sales
Sleeve				Burke Sales



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