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Procedure
for

Toxic Gas Monitoring System Requirements and Configuration

REVISION

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1. PURPOSE AND SCOPE

The purpose of this document is to establish usual requirements for the Toxic Gas Monitoring System (TGMS) at Albany NanoTech Complex (ANC). This includes the usual components of the TGMS, as well as the annunciation levels associated with conditions monitored by the TGMS.

2. EXCEPTIONS

Any exceptions to the requirements set out in this document must be approved by the NY CREATES Associate Vice President (AVP) of Environmental Health and Safety (EHS).

3. DEFINITIONS & ACRONYMS

3.1 EHS – NY CREATES Environmental, Health, and Safety

3.2 ERT – Emergency Response Team

3.3 **Hazardous Gas** – A gas (or mixture of gases) that is toxic, an irritant, corrosive, combustible, flammable, dangerously reactive, pyrophoric, or that otherwise may cause substantial acute or chronic personal injury or illness during, or as a direct result of, any customary or reasonably foreseeable handling or use.

3.4 **Hazardous Production Area (HPA)** – Any area that may reasonably be exposed to a hazardous gas and is continuously occupied by personnel in the normal performance of their job.

3.5 **Hazardous Production Material (HPM)** – Any material that presents a toxicity or safety risk to personnel in the area.

3.6 **Lowest Alarm Level (LAL)** – For sensors or devices with an internal 'Alarm' signal, the LAL is the lowest possible setting for the internal 'Alarm' signal to be tripped.

3.7 **Lower Explosive Limit (LEL)** – The minimum concentration of flammable gas or vapor mixed with air that can be ignited. LEL is typically expressed as a percent of flammable gas or vapor in air.

3.8 **NFC** – Nano Fab Central

3.9 **NFN** – Nano Fab North

3.10 **NFS** – Nano Fab South

3.11 **NFSX**– Nano Fab South Annex

- 3.12 **NFX** – Nano Fab Xtension **Permissible Exposure Limit (PEL)** – The maximum permitted 8-hour time-weighted average concentration of an airborne contaminant established by the Occupational Safety and Health Administration (OSHA).
- 3.13 **SCADA** – Supervisory Control and Data Acquisition
- 3.14 **TGMS** – Toxic Gas Monitoring System
- 3.15 **Threshold Limit Value (TLV)** – The 8-hour time-weighted average concentration of a hazardous chemical that an average person may be exposed to day after day without any adverse effect. TLVs are guidelines established by the American Conference of Governmental Industrial Hygienists.
- 3.16 **TO** – Tool Owner
- 3.17 **VESDA** – Very Early Smoke Detection Apparatus

4. ASSOCIATED DOCUMENTS

- 4.1 **TGM-00001** – Specification for Installation of Toxic Gas Monitoring System

5. TGMS

- 5.1 The TGMS tracks and controls the distribution of toxic / hazardous gases / chemicals at [ANC](#). The backbone of this system is an isolated fiber-optic and Ethernet network of Area Alarm programmable-logic Controllers (AAC) and SCADA computers / servers.

6. SCADA COMPUTER / SERVER

- 6.1 A distributed computer / server system provides site-wide monitoring, reporting, and historical data storage for all AACs. This system is composed of several computers/servers running commercial SCADA software (GE Proficy iFix).
- 6.2 The TGMS SCADA Servers are located in the NFN TGMS Server Room near the NFN Fab-level pass through. TGMS SCADA Access Nodes are located in the NFE Security Control Center, NFN, NFC, NFS, NFSX and NFX.
- 6.3 If any TGMS SCADA Access Node is found to be NOT 100% functional, contact the TGMS Technicians at 518-620-6GAS or EHS immediately by phone or email.

7. SCADA ACCESS NODES

- 7.1 The master SCADA Access Node is located in the NFE building Rotunda within the Security Control Center. From this SCADA Access Node, all sensor conditions can be viewed, logged, and printed out, if detailed trends are required for analysis. (TGMS Services is available to assist with any detailed or complicated data analysis/processing requirements.)
- 7.2 Remote SCADA Access Nodes are located in:
- NFS at the rear entrance
 - NFSX at the rear entrance
 - NFN at the Fab-level pass through and sub-Fab level pass through
 - NFC near the sub-Fab level pass through, Fab-level gowning room, and near the ERT office
 - NFX in the CSR gowning room, the META gowning room, the sub Fab by the north-west stairwell, outside the loading dock, and in HPM-corridor office (Room 235)
- 7.3 If an alarm, warning, or trouble condition is detected anywhere on the TGMS, status information will be available on all SCADA Access Nodes. These SCADA Access Nodes are capable of viewing current conditions at any local AAC, to acknowledge alarm / warning / trouble annunciations, and to examine historical trends of any monitored sensors.
- 7.4 These SCADA Access Nodes are password protected to prevent unauthorized personnel from accessing the system.
- 7.5 Every screen of the TGMS SCADA Access Node has a 'Screen Header' at its top and a 'Screen Footer' at its bottom. The 'Screen Header' shows the current screen title, the user currently logged into the Node, and the current time and date. The 'Screen Footer' shows the most recent alarm / warnings/trouble annunciations on the TGMS, as well as navigation buttons to select different screens.
- 7.6 The 'Main Overview Screen' shows an overview of the [ANC](#). Each monitored area is animated based on the present status condition in that area. If the area is depicted with a blinking color, this indicates that there are active annunciations in the area which have not been acknowledged. If the area is depicted with a solid color, this indicates that there are annunciations in the area which have been acknowledged, but have not yet been corrected.
- 7.7 Active alarm, warning, trouble, and other annunciations are indicated throughout the various SCADA screens by blinking animations. Once each annunciation has been acknowledged, the animation will stop blinking and be displayed as a solid color until the offending condition is corrected.

7.8 The following colors are associated with particular annunciation conditions:

- Red – Alarm
- Yellow – Warning
- Magenta – Sensor / Device Trouble
- Cyan – Wire Break
- Blue – Disabled for Maintenance
- Pink – Unacknowledged annunciation at local AAC
- Orange – Communication Failure with AAC



7.9 Each 'Area Overview Screen' shows an overview of a particular area or building [at ANC](#). All the AACs contained in this area are depicted in their relative location. Each monitored AAC is animated based on its present status condition.

- If the AAC is depicted with a blinking color, this indicates that there are active annunciations on the AAC which have not been acknowledged.
- If the AAC is depicted with a solid color, this indicates that there are annunciations on the AAC which have been acknowledged but have not yet been corrected.

7.10 The 'Alarm Summary screen' displays all of the global annunciations that are currently present in the system.

7.10.1 The 'Acknowledge All' button allows the operator to acknowledge all global annunciations that are currently present. The 'Alarm History screen' displays a list of cleared annunciations.

7.11 Each 'AAC Detailed Information screen' shows all the analog sensors and discrete devices connected to that AAC, as well as, the current reading, alarm set point, and warning set point for each sensor or device.

- 7.11.1 Historical trends are available for any of the sensors by clicking the sensor name on the 'AAC Detailed Information screen'.

8. SCADA SYSTEM BACK UP

TGMS SCADA computers / servers will be automatically backed up weekly. The SCADA system backup is controlled and maintained by TGMS Services.

9. AREA ALARM PROGRAMMABLE-LOGIC CONTROLLERS (AAC)

- 9.1 AACs provide local monitoring, control, and protection on a continuous basis for a particular tool, for a particular area, or for a particular group of shared support equipment.
- 9.2 Each tool that has HPMs or hazardous potentials of any type shall have its own AAC.
- 9.3 Each AAC typically has at least one Human Machine Interface (HMI) attached to it. The HMI is a touch-sensitive screen, where the condition and any annunciation of all local sensors and devices attached to the AAC are displayed. The HMI can also be used to acknowledge any annunciations being reported on that AAC. All HMIs are required to have memory cards installed which contains a backup of the HMIs software.
- 9.4 Each AAC typically also has a 'light tower and horn' attached to it. The 'light tower and horn' attached to each AAC is used to broadcast any annunciation associated with that AAC to the surrounding local area – both visually and audibly.
- 9.5 Each AAC also has a connection panel inside its enclosure. Power, sensor, and device inputs arrive to the AAC on the connection panel; power, sensor, and device outputs leave the AAC from the connection panel. All necessary power and signal interconnects within the AAC originate and/or terminate within the connection panel.
- 9.6 All new, as well as any altered AAC panel is required to have the complete, up-to-date, as-built drawing placed within the AAC enclosure no later than two (2) weeks after EHS/TGMS Services has signed off on the associated TGMS testing.
- 9.7 An electronic copy of these drawings must also be provided to TGMS Services via email or CD.

- 9.8 Analog sensors typically employed in the TGMS are:
- Gas sensors to monitor any hazardous gaseous chemicals.
 - Pressure sensors with appropriate attachments to monitor necessary exhaust conditions.
 - Other sensors deemed appropriate to monitor a particular hazardous condition.
- 9.9 Discrete devices typically employed in the TGMS are:
- Temperature devices to monitor flammable, explosive, or pyrophoric situations.
 - Leak devices to monitor potential liquid leaks.
 - Annunciation lights and horns
 - Manual switches or buttons
 - Other devices deemed appropriate to monitor a particular hazardous condition (e.g., Abatement system faults or alarms, etc.)
- 9.10 Other signals typically employed in the TGMS are:
- Tool Enable – sent to a tool to indicate it is ok for the tool to process wafers.
 - Tool Ready – sent from a tool to indicate it is ready to process wafers.
- 9.11 On-board Fire Detection / Suppression – sent from a tool to indicate the tool's on-board fire detection/suppression has been activated. TGMS is only a 'secondary' monitor of this signal the primary monitor of this signal is the Fire Alarm System.
- 9.12 The signals from all sensors and devices are wired to the corresponding AAC for monitoring and control. All signals shall be suitable for a 24V circuit.
- 9.13 Terminal block connections are the preferred landing for all signal wires. Tool Owner will be required to facilitate all connections to the tool and its support equipment. Tool Owner is also responsible for any mating connectors required to complete these connections.
- 9.14 All equipment installed as part of the TGMS must be pre-approved by EHS and TGMS Services. Any new equipment will be installed for a 6-month trial period.

- 9.15 If a device is deemed unfit for use during this period by either EHS or TGMS Services, the device will be removed from service. The Tool or Equipment Owner will then be required to supply a suitable, pre-approved replacement.
- 9.16 An AAC associated with a tool monitors the 'ready' signal from gas cabinets, chemical dispense units (CDUs), valve manifold boxes (VMBs), and other pieces of equipment supporting the tool. When the AAC is receiving an active 'ready' signal from all monitored pieces of equipment supporting a tool, it will send the tool/process module of the tool an 'enable' signal.
- 9.17 An AAC associated with a tool will also monitor the 'Emergency Manual Off (EMO)' signal from the tool. If the AAC receives an active 'EMO' signal, the AAC will deactivate all gas/chemical request signals sent to support equipment on behalf of the tool, as well as deactivate all tool/process module 'enable' signals sent to the tool.
- 9.18 An AAC associated with a particular area, region, or facility [on the ANC](#) will monitor all the TGMS Emergency Evacuation Buttons for that particular area, region, or facility. If any of the TGMS Emergency Evacuation Buttons are activated, the AAC will activate the evacuation strobe lights and horns (a.k.a. Blue Lights) within the area, region, or facility. The AAC will not shut down any equipment or tools.
- 9.19 All TGMS Emergency Evacuation Buttons will be tested and verified twice each year during facility shutdowns/idles.
- 9.20 An AAC associated with a particular group of shared support equipment will monitor all the TGMS Emergency Shutdown Buttons for that particular group of shared support equipment. If any of the TGMS Emergency Shutdown Buttons are activated, the AAC will deactivate all gas/chemical supplies within the particular group of shared support equipment.
- 9.21 All TGMS Emergency Shutdown Buttons will be tested and verified twice each year during facility shutdowns/idles.
- 9.22 All shared gas cabinets, VMBs, or CDUs will be monitored via a dedicated AAC.

10. ANNUNCIATION LEVELS TYPICALLY EMPLOYED WITH SENSORS AND DEVICES IN THE TGMS

- 10.1 **Alarm** – a condition that represents an extremely pressing threat to the environmental health and/or safety of any personnel or facility. Such a condition will typically be globally and locally annunciated, lead to local indicators, paging of appropriate individuals, and/or the affected area or region being evacuated.

- 10.1.1 If it exists, the internal 'Alarm' signal of all sensors and devices is wired directly to corresponding equipment to be controlled. In these situations, a sensor or device that goes into an 'Alarm' state will shut down the corresponding equipment to be controlled, even if it has lost the ability to communicate with its AAC.
- 10.2 **Warning** – a condition that if not mitigated could potentially lead to a threat to the environmental health and/or safety of any personnel or facility. Such a condition will typically be globally and locally annunciated, lead to local indicators, but not directly lead to the affected area or region being evacuated.
- 10.2.1 A few warning conditions are only locally annunciated, lead to local indicators, but not directly lead to the affected area or region being evacuated. These are always tool-centric conditions such as a door open signal, a subcomponent not ready signal, etc. Such locally annunciated warnings must be acknowledged directly on the local AAC.
- 10.3 **Sensor/Device Trouble** – when an AAC receives a trouble signal from a gas sensor for longer than five minutes, it will annunciate the problem locally, globally, and via paging. If the condition causing the trouble signal is not corrected within an additional 55 minutes, all gas supplies being monitored by this sensor will be shut off.
- 10.3.1 When an AAC receives a trouble signal from a temperature-monitoring device, it will immediately annunciate the problem locally, globally, and via paging. If the condition causing the trouble signal is not corrected within sixty minutes, all potential hazards will be shut off (including potentially all hazardous gases, as well as *possibly* the tool itself).
- 10.4 **Wire Break** - when an AAC receives a wire break signal from a gas sensor for longer than five minutes, it will annunciate the problem locally, globally, and via paging. If the condition causing the trouble signal is not corrected within an additional 55 minutes, all gas supplies being monitored by this sensor will be shut off.
- 10.4.1 When an AAC receives a trouble signal from a temperature-monitoring device, it will immediately annunciate the problem locally, globally, and via paging. If the condition causing the trouble signal is not corrected within sixty minutes, all potential hazards will be shut off (including potentially all hazardous gases, as well as, possibly the tool itself).
- 10.5 **Placed in Maintenance Mode** – when an AAC, sensors, and/or devices have been disabled for maintenance, it will annunciate this status locally, globally, and via paging.
- 10.6

Communication Failure - when the SCADA Servers are not able to communicate with an AAC or any other component on the TGMS backbone, they will annunciate the problem globally and via paging. TGMS Service should be contacted if this situation persists for an extended period of time.

11. SENSORS AND DEVICES

All sensors and devices used in the TGMS must be approved by TGMS Services, while the location of each sampling point must be approved by EHS.

11.1 Gas Sensors

11.1.1 Per New York State Fire Code, a minimum of three (3) detection points are required for monitoring any HPM used in a specific piece of equipment. They shall be located as follows:

- a) The exhaust of any piece of equipment that utilizes an HPM.
- b) The exhaust of any enclosure that creates/stores an HPM or through which an HPM moves.
- c) The ambient air in an HPA. In regard to this requirement, an HPA cannot extend from one floor of a building to another.

11.1.2 TGMS shall utilize only dedicated gas sensors, supplied as part of the TGMS installation. Any onboard gas sensors installed within a tool may be used by the tool itself but not by the TGMS.

11.1.3 Combining gas detection into a single point within an exhaust duct is allowed, provided it can be demonstrated that it meets the code requirement for detecting a leak at the PEL in each single enclosure. EHS must be provided with appropriate calculations supporting any such implementation.

11.1.4 Gas sensors should be installed at least five duct diameters upstream from a monitored-gas vent line. Gas sensors must be mounted five duct diameters after any elbow and/or transition and five duct diameters before any blast gate. Gas sensors shall be mounted pointing as close to downward as feasible.

11.1.5 Ambient air shall always be sampled downstream from any occupied area relative to the prevailing air-flow pattern.

11.1.6 At the FAB level, this will typically be below the raised floor or just below the waffle slab.

11.1.7 At the sub-Fab level, this will typically be at a height of 5' from the floor around any vacuum pumps and/or abatement units.

- 11.1.8 Gas sensors are not required for vacuum-pump exhaust, vacuum-pump skin exhaust, or point -of-use abatement process exhausts.
- 11.1.9 For gases heavier than air, it is recommended that the sampling point be installed approximately 18" from the floor. In these applications care should be taken to protect the sampling point from physical damage. For gases that are lighter than air, sampling points should be installed as close as feasible to the potential leak.
- 11.1.10 All gas sensors shall be extractive type sensors, unless prior approval by TGMS Services is obtained. Placement of the sampling point shall be approved by EHS, while placement of the sensor shall be approved by TGMS Services. Tubing from each sample point to the sensor should be labeled at the beginning and at end as well as at 10' intervals thereafter.
- 11.1.11 All gas sensors are to be located within an area that complies with the specified operational conditions for the unit. Always avoid areas of continuous high (>90%) or low (<20%) relative humidity.

11.2 Pressure Sensors and Devices

- 11.2.1 Any exhausted enclosure containing an HPM shall have its exhaust flow monitored via a pressure sensor with appropriate accessories. The process exhaust flow from any abatement unit shall also be monitored via a pressure sensor with appropriate accessories. Additionally, the inert-gas purge flow of any vent line for an HPM (especially Silane) shall also be monitored via a pressure sensor with appropriate accessories. In the event that the required exhaust flow is too small to be accurately monitored, a static pressure measurement may be substituted with EHS and TGMS Services approval.
- 11.2.2 Upon activation of an exhaust flow and/or pressure sensor annunciation, the entire tool affected must be shut down. If individual components of the tool are controlled and/or enabled separately, then only those components contributing to the exhaust flow and/or pressure sensor that has been activated are required to be shut down.
- 11.2.3 Coaxial HPM transport lines that have pressurized or evacuated outer jackets to ensure the integrity of the HPM transport line shall have the pressure of the jacket monitored via a pressure device. When such a pressure device detects a change in jacket pressure, valves feeding the HPM through the line shall be closed.

11.3 Temperature Sensors and Devices

- 11.3.1 Any exhausted enclosure containing an explosive/flammable HPM shall have its exhaust temperature monitored via a temperature sensor / device.

- 11.3.2 When such a temperature device is activated, the valves feeding all HPMs to the tool shall be closed and the tool as well as all its support equipment shall be shut down.
- 11.3.3 When such a temperature sensor/device is activated in a shared support equipment area, the valves feeding all HPMs from the area shall be closed and a signal shall be issued to evacuate the shared support area.
- 11.3.4 Any exhausted enclosure containing a pyrophoric HPM shall have its exhaust temperature monitored via a Dual IR, UV-IR temperature device, or VESDA system.
- 11.3.5 When such a Dual-IR, UV-IR temperature device, or VESDA system is activated, the valves feeding all HPMs from/through the enclosure shall be closed and the tool, as well as all its support equipment shall be shut down.
- 11.3.6 When such a Dual-IR, UV-IR temperature device, or VESDA system is activated in a shared support equipment area, the valves feeding all HPMs from the area shall be closed and a signal shall be issued to evacuate the shared support area.
- 11.3.7 In the case that temperature sensors on LDS Cabinets, or chamber gas boxes, will be disabled for an extended period of time they can be disabled and hidden from view until the time comes for either removal or reuse. This must be approved by EHS and the TGMS team first.

12. SET POINTS

12.1 Gas Sensors

- 12.1.1 Alarm annunciation set points must never exceed the TLV or twenty percent of the LEL for the monitored gas. The standard alarm annunciation set point shall be one half of the TLV or twenty percent of the LEL for the target gas. If the target gas is both toxic and flammable the lower of the aforementioned two values shall be the alarm annunciation set point.
- 12.1.2 Unless placed in Maintenance Mode, any HPM gas sensor exceeding its alarm annunciation set point shall result in the evacuation of the appropriate surrounding area.

- 12.1.3 Warning annunciation set point should be no more than half the concentration level of the Alarm annunciation set point and, when possible, the associated sample time should not exceed 30 seconds. If the desired warning annunciation set point is lower than the lowest concentration level that can be detected by a sensor, then the warning annunciation set point shall be set to lowest detectable concentration for the sensor.

In the case that gas detectors on LDS Cabinets, or chamber gas boxes will be disabled for an extended period of time they can be disabled and hidden from view until the time comes for either removal or reuse. This must be approved by EHS and the TGMS team first.

12.2 Pressure Sensors

- 12.2.1 Alarm annunciation set points when used as static pressure sensors: the low alarm annunciation set point should be 75% of the normal steady state sensor reading, while the high alarm annunciation set point is not required. All such set points should be exceeded for duration more than 30 seconds prior to initiating an alarm annunciation.
- 12.2.2 When used as flow sensors, the low alarm annunciation set point should be 75% of the normal steady state sensor reading, while the high alarm annunciation set point is not used. All such set points should be exceeded for duration more than 30 seconds prior to initiating an alarm annunciation.
- 12.2.3 Warning annunciation set points when used as static pressure sensors: the low warning annunciation set point should be 81% percent of the normal steady state sensor reading, while the high warning annunciation set point should be 123% of the normal steady state sensor reading. All such set points should be exceeded for duration of more than 30 seconds prior to initiating a warning annunciation.
- 12.2.4 When used as flow sensors, the low warning annunciation set point should be 90% of the normal steady state sensor reading, while the high warning annunciation set point is not used. All such set points should be exceeded for duration of more than 30 seconds prior to initiating a warning annunciation.

12.3 Temperature Devices

Alarm annunciation set point the typical temperature device used shall have an alarm annunciation set point of 150 degrees Fahrenheit.

12.4 Warning Annunciation Set Point

The typical temperature device used does not need to have a warning annunciation set point.

13. USE OF MAINTENANCE MODE

- 13.1 Maintenance Mode is designed to allow known maintenance activities to occur without the risk of evacuating the surrounding area or facility. The tool will remain pseudo operational; however, all HPMS cannot be enabled, evacuation light and horns will not activate, ERT paging will not take place, all sensors and devices will remain operational but will only provide local annunciation at the AAC. The following people are the only personnel authorized to place an AAC into Maintenance Mode:
- Tool's owners
 - EHS personnel
 - TGMS Services personnel
 - ERT personnel
 - NY CREATES authorized TGMS Contractor personnel
- 13.2 The use of Maintenance Mode is only allowed once all hazards, which may harm employees performing any service or maintenance, have been isolated from their source and rendered inoperable. (These hazards include all unexpected energization or release of stored energy, such as electrical, chemical, thermal, mechanical, or other energy.)
- 13.3 Any person placing a tool into Maintenance Mode must Contact Security with the following information:
- Tool's Hex ID
 - Their name, title, and contact number
 - A brief explanation of the reason for placing the tool in Maintenance Mode
 - Estimated duration for the planned maintenance activities
- 13.4 If any person placing a tool into Maintenance Mode needs to transfer responsibility for the Maintenance Mode activity (such as the end of their work shift), they must contact Security to inform them of the transfer of responsibility.
- 13.5 When any Maintenance Mode activity is completed, the person with responsibility for the Maintenance Mode activity shall remove the tool from Maintenance Mode and shall contact Security to inform them the work is complete.

14. TGMS INSTALLATION AND MAINTENANCE

- 14.1 TGMS installations shall ONLY be completed by either TGMS Services personnel or the Authorized TGMS Contractor personnel. Whenever possible, any TGMS maintenance shall be completed by either TGMS Services personnel or Authorized TGMS Contractor personnel.
- 14.2 In the event neither TGMS Services personnel nor Authorized TGMS Contractor personnel are available to complete a required maintenance task, EST personnel, EHS personnel, or ERT personnel may complete the required maintenance task if they have been trained to do so by TGMS Services.
- 14.3 Scheduled TGMS maintenance shall be documented and supervised if not performed by the TGMS Services.
- 14.4 TGMS Services shall coordinate maintenance on the following system components, in accordance with the manufacturer's instructions, in accordance with the manufacturer's recommend interval, in accordance with an 18-month preventative maintenance plan, and/or during bi-yearly facility shutdowns / idles:
- Strobe lights and horns
 - Gas sensors
 - Gas sensor extractive tubing
 - Temperature sensor and devices
 - Pressure sensors and devices
 - TGMS manual switches and buttons
 - Facility catastrophic-release exhaust response
- 14.5 Any new TGMS equipment or existing TGMS equipment that is being modified, updated, or otherwise altered in any way, shall be tested by TGMS Services to function per the TGMS Matrix for the AAC prior to being accepted by TGMS Services and EHS.
- 14.6 A pre-tested TGMS Matrix must be completed, signed (by IC, EE, and TGMS Contractor), and submitted to TGMS Services in order to schedule an "official" TGMS testing session.
- 14.7 TGMS testing is supported by TGMS Services Monday through Friday during normal business hours.
- 14.8 If TGMS Services must bypass TGMS Evacuation strobe lights and horns for the requested testing, additional TGMS Services / ERT / EHS personnel will also be needed to monitor the TGMS throughout the testing.

- 14.9 If TGMS testing will require activation of any TGMS Evacuation strobe lights or horns, testing will only be allowed before 8:00 AM or after 5:00 PM, Monday through Thursday.
- 14.10 Any existing TGMS equipment that is being modified, updated, or otherwise altered in any way shall be updated to conform with the TGMS specifications published on the Intranet at the time of the TGMS testing required to place the equipment back in service.

15. RECORDS

- 15.1 All records associated with the deletion/addition of monitoring points to the TGMS shall be kept on file by the EHS Department and TGMS Services for a minimum of three years.
- 15.2 All records associated with the completion of scheduled maintenance of the TGMS shall be kept on file by TGMS Services for a minimum of three years.

16. APPENDICES

Appendix A – TGMS Text Guideline for AAC, SCADA, and Paging System

Appendix B – ACC Display Definitions

Appendix C – TGMS Testing Verification

APPENDIX A

TGMS Text Guideline for AAC, SCADA, and Paging System

AAC Screen		
Group	Text	Banner
Leak Alarms	Tool ID Location Liquid Leak	Alarm
Heat Detectors	Tool ID Location Exhaust HD#	Alarm
Pressure Detectors	Tool ID Location PT#	Warning/Alarm
Gas Detectors	Tool ID Chemical Formula GD# Exh/Amb	Wirebreak/Trouble/Warning/Alarm
Tool Interlocks *	Tool ID Tool Interlock (Name)	Alarm
Other Interlocks *	Tool ID Location Other Interlock (Name)	Alarm
SCADA Screen		
Group	Text	Banner
Leak Alarms	Tool ID Location Liquid Leak	Alarm
Heat Detectors	Tool ID Location Exhaust HD#	Alarm
Pressure Detectors	Tool ID Location PT#	Warning/Alarm
Gas Detectors	Tool ID Chemical Formula GD# Exh/Amb	Wirebreak/Trouble/Warning/Alarm
Other Interlocks *	Tool ID Location Other Interlock (Name)	Alarm
Alarm Notification (Paging)		
Group	Text	Banner
Leak Alarms	Tool ID Location Liquid Leak	Alarm
Heat Detectors	Tool ID Location Exhaust HD#	Alarm
Pressure Detectors	Tool ID Location PT#	Warning/Alarm
Gas Detectors	Tool ID Chemical Formula GD# Exh/Amb	Wirebreak/Trouble/Warning/Alarm
Other Interlocks *	Tool ID Location Other Interlock (Name)	Alarm
Tool Interlock *	Includes all, but not limited to, gas availability calls, EMO, pump dilution, pump purges, switches, abatement unit warnings, gas detector enable, and GIB faults	
Other Interlocks *	Includes all, but not limited to, Scrubber Faults, CM4 Trouble/Alarm	

APPENDIX B – ACC DISPLAY DEFINITIONS

1st Floor GIB (sub FAB)	
1G1	GIB Box #1
1G2	GIB Box #2
1G3	GIB Box #3
1G4	GIB Box #4
2nd Floor GIB (FAB)	
2G1	GIB Box #1
2G1	GIB Box #1
2G2	GIB Box #2
2G3	GIB Box #3
2G4	GIB Box #4
1st Floor Vacuum Pumps (sub FAB)	
1V1	Process Chamber Pump #1
1V2	Process Chamber Pump #2
1V3	Process Chamber Pump #3
1V4	Process Chamber Pump #4
1st Floor Abatement (sub FAB)	
1A1	Exhaust Scrubber #1
1A2	Exhaust Scrubber #2
1A3	Exhaust Scrubber #3
1A4	Exhaust Scrubber #4
2nd Floor Chamber (FAB)	
2M1	Process Chamber #1
2M2	Process Chamber #2
2M3	Process Chamber #3
2M4	Process Chamber #4
Pressure Detectors	
PT1	Pressure Transmitter 1
PT2	Pressure Transmitter 2
PT3	Pressure Transmitter 3
PT4	Pressure Transmitter 4
Heat Detector	
HD1	Heat Detector #1
HD2	Heat Detector #2
HD3	Heat Detector #3
HD4	Heat Detector #4
Gas Detectors	
GD1	Gas Detector #1
GD2	Gas Detector #2
GD3	Gas Detector #3
GD4	Gas Detector #4
Leak Detectors	
LD1	Leak Detector #1
LD2	Leak Detector #2
LD3	Leak Detector #3
LD4	Leak Detector #4

Abbreviations	
AMB	Ambient Sensor Location (work area gas sensor)
"WC	Inches of Water Column (exhaust pressure readout)
%	Percent
03 Gen.	Ozone Generator
BN2	Bottle Nitrogen
CDU	Chemical Dispense Unit (containment with leak detector)
COAX	Coax Switch
CUB	Central Utility Building
Cyl	Cylinder
EMO	Emergency Off Button
EXH	Exhaust Sensor Location (ventilation ductwork gas sensor)
FLAM	Flammable
GB	Gas Box
GEN	Generator (Ozone)
GIB	Gas Isolation Box
GRC	Gas Reactor Column
HD	Heat Detector
HPM	Hazardous Production Material
LDS	Liquid Dispense System
LPN	Low Purity Nitrogen
NFNCDU	NFN Chemical and Solvent rooms off (HPM corridor)
NFNGAS	NFN Gas Cabinets/Rooms
NFNVMB	NFN Valve Manifold Box
OXY	Oxidizer
Onboard Leak	Tool Leak Alarm
PLC	Programming logic controller
PPB	Parts Per Billion
PPM	Parts Per Million
Pump Jacket	Exhausted Enclosure on a process pump
Purf. Building/Room	Purification Building/Room
Str	Storage
SW	Switch
TCS	Thermal Conditioning System
TPU	Thermal Processing Unit
UVIR	Temperature Detection
VMB	Valve Manifold Box
VESDA	Very Early Smoke Detection Apparatus

Appendix C – TGMS TESTING VERIFICATION

Sensor/Device Tested:	How?	Tool Enable	AAC Light	AAC HMI Text	SCADA	ERT Page	Blue Lights	VMB/GIB Status
Gas Detectors	Bump test with gas, Matrix is Verified	OFF	ON	ON - Screen Text/Alarm Displayed Verified	Verify	ON	ON	OFF
Gas Detector Trouble	Simulate "real" trouble alarm - 5 min. time delay 55-minute countdown gas shutdown - text changes color	ON	ON	ON - Screen Text/Alarm Displayed Verified	Verify	ON	OFF	ON
Pressure Transmitters	Pull tubing from transmitter (verify pressure drop)	OFF	ON	ON - Screen Text/Alarm Displayed Verified	Verify	OFF	OFF	OFF
UV-IR/Dual IR Detector	Test with appropriate test light	OFF	ON	ON - Screen Text/Alarm Displayed Verified	Verify	ON	OFF	OFF
Leak Detection	Dip sensor in liquid (if liquid sensor) Lift float (if float sensor)	OFF	ON	ON - Screen Text/Alarm Displayed Verified	Verify	ON	OFF	OFF
Temperature Detectors	Pull Contact Wire	OFF	ON	ON - Screen Text/Alarm Displayed Verified	Verify	ON	OFF	OFF
AC Power Failed	Pull Relay	ON	ON	ON - Screen Text/Alarm Displayed Verified	Verify	OFF	OFF	ON
Maintenance Mode	Enter Password Verify gases off on AAC DO NOT TEST GD Bypass mode	ON/OFF	OFF	ON - Screen Text/Alarm Displayed Verified	Verify	OFF	OFF	ON/OFF
PLC Battery Low	Pull batteries from PLC (Verify annunciation)	ON	ON	ON - Screen Text/Alarm	Verify	OFF	OFF	ON

	(Newer PLCs have no battery.)			Displayed Verified				
Door Switch Ready	Open Door	OFF	ON	ON - Screen Text/Alarm Displayed Verified	Verify	OFF	OFF	OFF
Gas Calls	Verify Signal on AAC (GIB/VMB/G.C.)	OFF	ON	ON - Screen Text/Alarm Displayed Verified	Verify	OFF	OFF	OFF
O3 Generator Ready	Verify Generator shuts down	OFF	ON	ON - Screen Text/Alarm Displayed Verified	Verify	OFF	OFF	OFF
Purge Systems (N2)	Turn off purge system (verify annunciation)	OFF	ON	ON - Screen Text/Alarm Displayed Verified	Verify	OFF	OFF	OFF
BN2 Switch	Drop indicator needle past set point (verify annunciation)	OFF	ON	ON - Screen Text/Alarm Displayed Verified	Verify	OFF	OFF	OFF
COAX Switch	Drop indicator needle past set point (verify annunciation)	OFF	ON	ON - Screen Text/Alarm Displayed Verified	Verify	ON	OFF	OFF
Scrubber Fault/Warning/Alarm	Have scrubber tech generate alarm condition or lift contact wire (verify annunciation). Also verify annunciation with HD/PT/GD	OFF	ON	ON - Screen Text/Alarm Displayed Verified	Verify	OFF	OFF	OFF

Tool Enable	ON - Indicates Tool "Normal" Operation
	OFF - Indicates Tool "SHUTDOWN"
AAC Light	ON - Indicates AAC Strobe Light "Flashing"
	OFF - Indicates AAC Strobe Light "IDLE"
AAC HMI Text	ON - Indicates Text displayed on AAC
	OFF - Indicates AAC display is clear
SCADA	Verified - Indicates TEXT is verified on SCADA system/TGMS Screen @ Security
ERT Page	ON - Indicates pages ERT group
	OFF - Indicates NO ERT group page
Blue Lights	ON - Indicates "BLUE LIGHTS"
	OFF - Indicates NO "BLUE LIGHTS"
VMB/GIB Status	ON - Indicates "Normal" tool operation
	OFF - Indicates VMB/GIB disabled (SHUTDOWN)