

# ENGINEERING KANSAS CITY AREA TRANSIT AUTHORITY

*MID-AMERICA ALTERNATIVE FUEL CODES SUMMIT  
OCTOBER 29, 2014*



JAY R. GUERRA PE  
PRINCIPAL  
MECHANICAL ELECTRICAL & PLUMBING



**GO  
NATURAL** 



## Compressed Natural Gas (CNG) Fueled Vehicles



Representatives from MGE/Laclede Gas, the Federal Transit Administration and Clean Energy help illustrate the savings that CNG will provide.



## Project Background - The CNG Basics

- The primary ingredient of natural gas is methane ( $\text{CH}_4$ ) which is nontoxic, odorless, colorless and tasteless.
- Natural gas is lighter-than-air and will rise under normal conditions; it's in a gaseous form at atmospheric conditions.
- Pipeline natural gas is odorized as a safety measure to allow human detection. Odorized natural gas can typically be detected by smell at approximately 1% natural gas in air.

## Project Background - The CNG Basics

- Between 5% and 15% natural gas is required to support combustion in the air.
- The ignition temperature of natural gas is approximately 1100°F
- CNG is stored on the vehicle in a gaseous form which has been compressed up to 3,600 PSI nominal pressure (at 70° F). At this pressure the volume of the natural gas is 3.5 times the volume of diesel containing the equivalent energy.

## Fleet Conversion – What is Required?





### KC ATA Facility Conversion (Buildings built in 1977)

- Vehicle Storage, Vehicle Maintenance
- Evaluate Ventilation Requirements
- Evaluate the potential of “Gas Pockets”
- Evaluate Electrical Requirements
- Elimination of High Temperature Surfaces
- Location of Fueling Stations
- Cost of Conversion
- Cost of Operation



# KCATA SITE

## LEGEND

-  Maintenance
-  Bus Storage
-  Bus Service (Fueling, Wash)
-  New CNG Transit Fuel Station

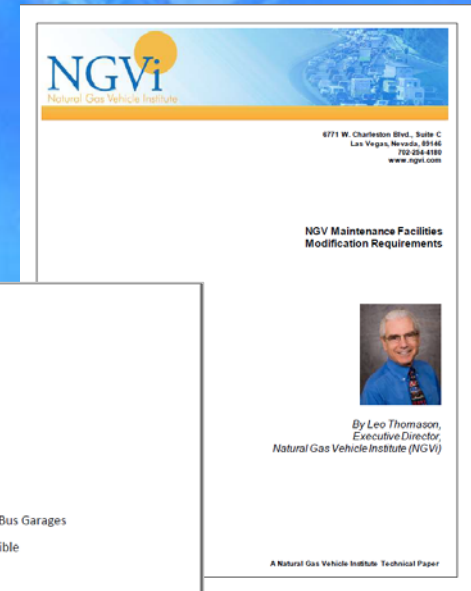
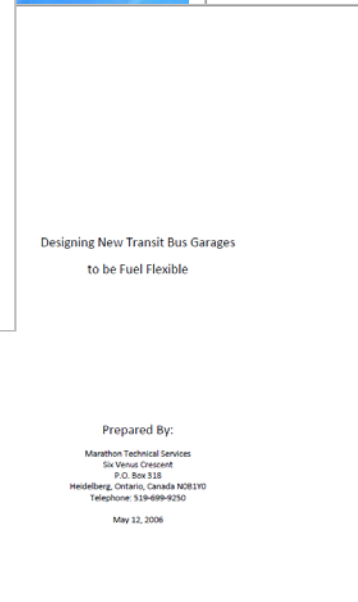
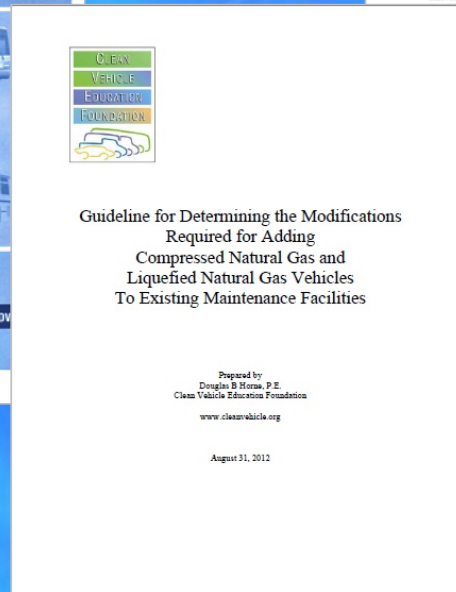
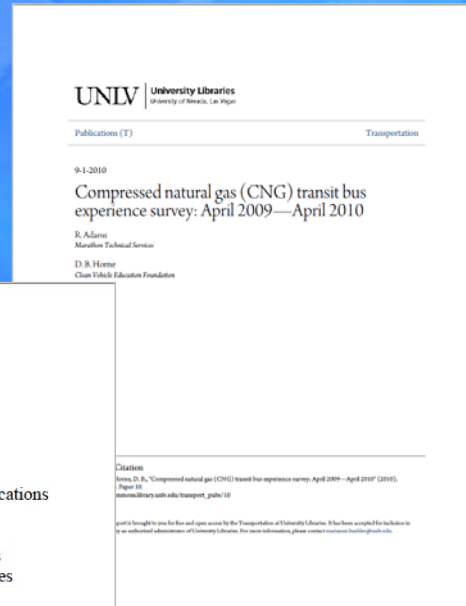
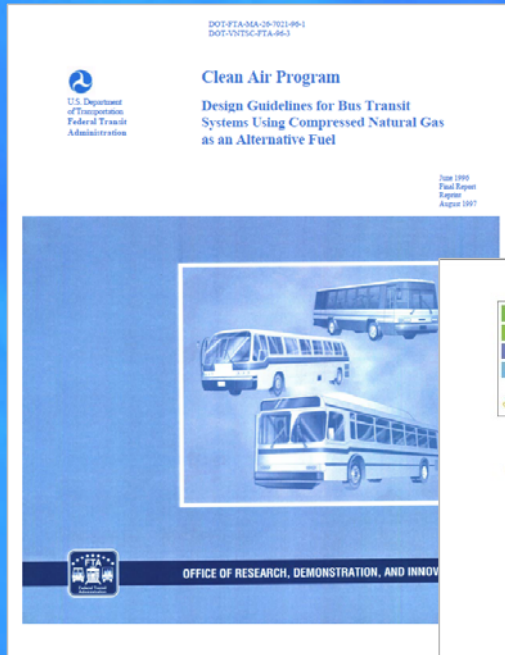
## National Codes Covering Vehicle Maintenance Facilities

- International Code Council's International Fire Code (IFC 2012)
  - International Mechanical Code (IMC 2012)
  - International Building Code (IBC 2012)
- National Fire Protection Association's NFPA 30A (2012)  
Code for Motor Fuel Dispensing Facilities and Repair Garages
  - NFPA 52 (2010) Vehicular Gaseous Fuel Systems Code
  - NFPA 88A (2007) Standards for Parking Structures



Modification Category	Code References
Ventilation	IMC (2012) Table 403.3; NFPA 88A (2007) 5.3.2; IFC (2009) 2211.7.1, 2211.1.1, 2211.7.1.2; NFPA 30A (2012) 7.5.1, 7.5.2, 7.5.3, 7.5.4, 7.4.7.2, 7.4.7.3
Ventilation in Pits	IFC (2009) 2211.3; NFPA 30A 7.4.5.4
Gas Detection	IFC (2009) 2211.7.2, 2211.7.2.1, 2211.7.2.2, 2211.7.2.3; NFPA 30A (2012) 7.4.7, 7.4.7.1, 7.4.7.2, 7.4.7.3, 7.4.7.4
Sources of Ignition	NFPA 30A (2012) 7.6.6
Electrical Classification	NFPA 30A (2012) 8.2.1
Preparation of vehicles for Maintenance	IFC (2009) 2211.5
Maintenance and decommissioning of containers	NFPA 52 (2010) 6.13, 6.14

# Guidelines that cover vehicle maintenance facilities

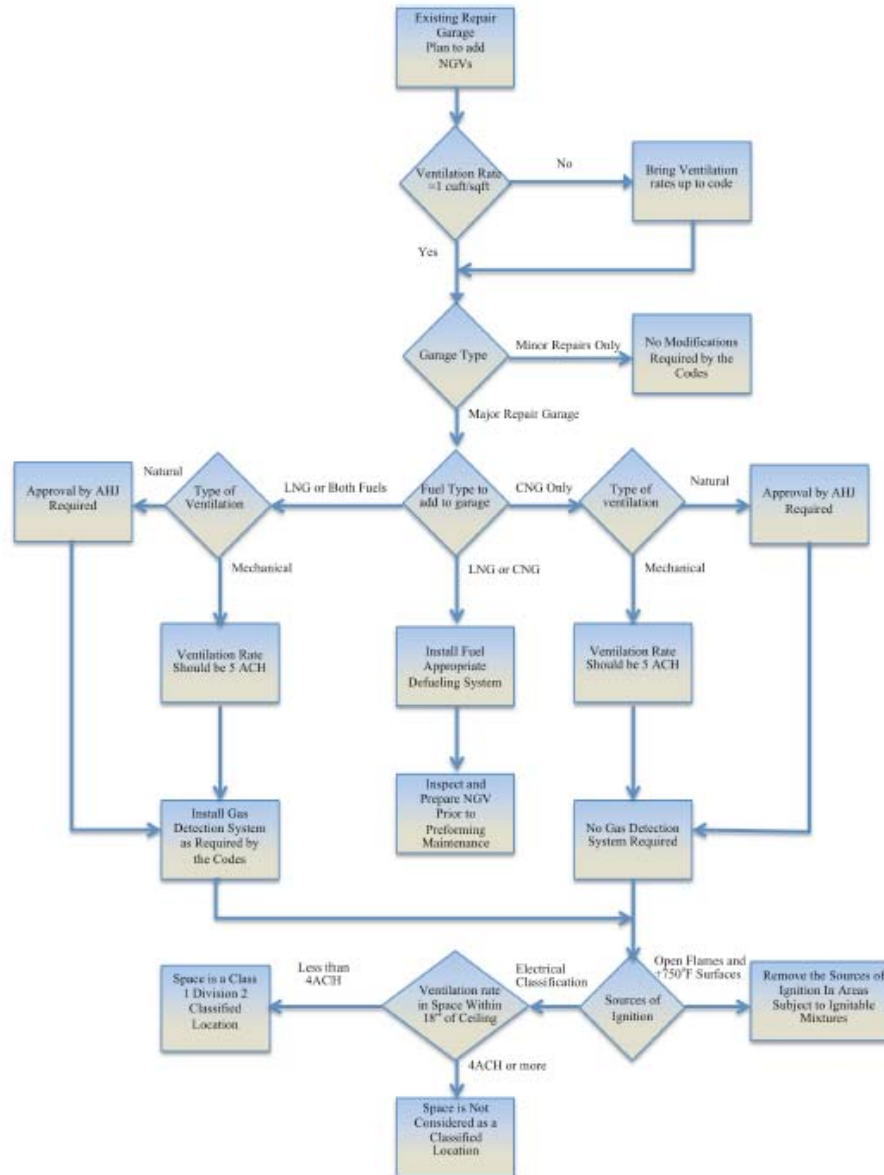




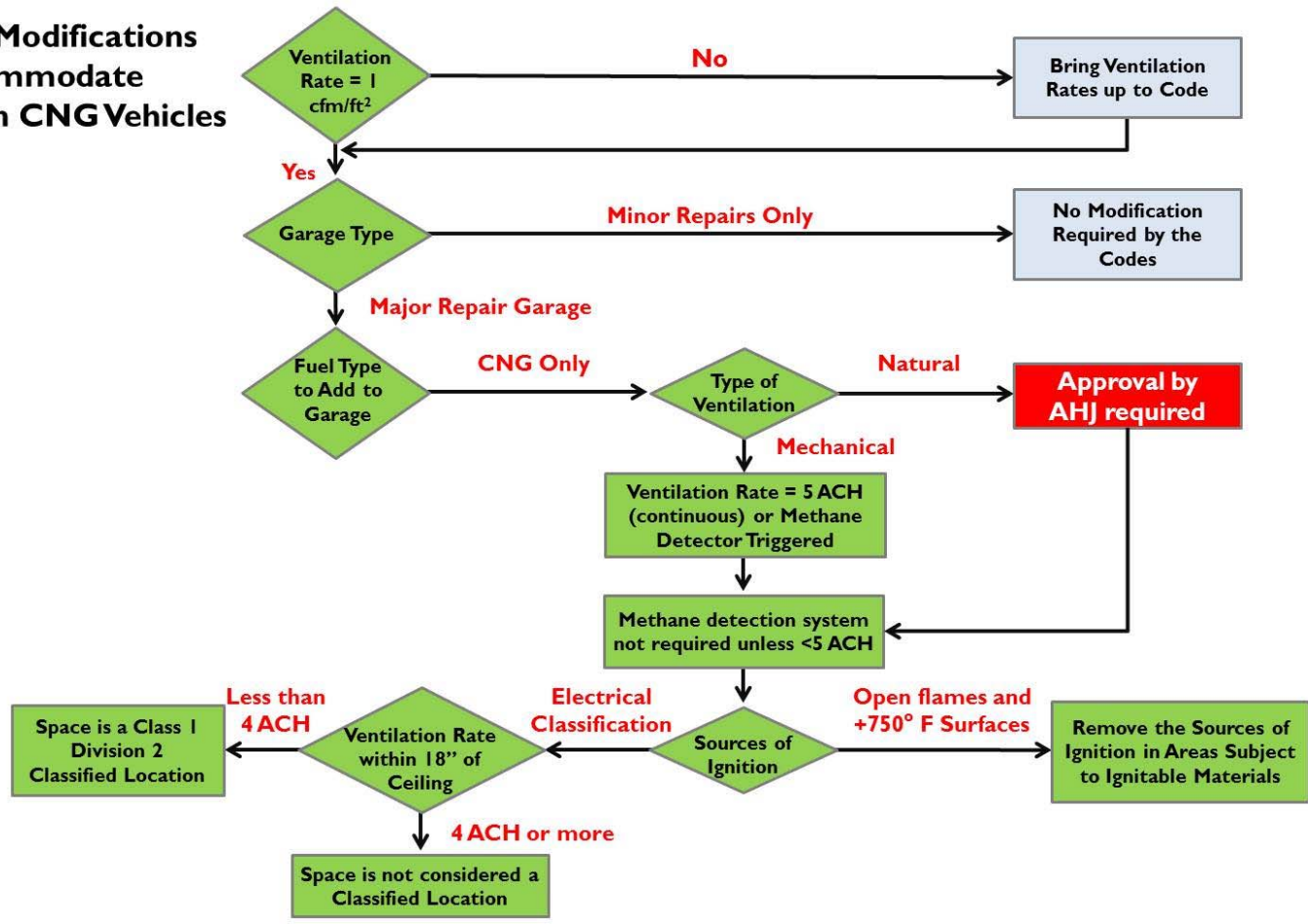
**Guideline for Determining the Modifications  
Required for Adding  
Compressed Natural Gas and  
Liquefied Natural Gas Vehicles  
To Existing Maintenance Facilities**

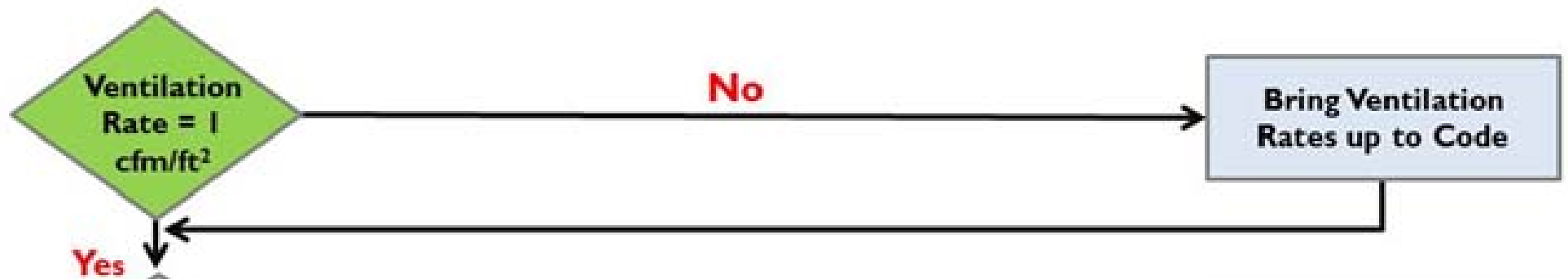
Prepared by  
Douglas B. Horne, P.E.  
Clean Vehicle Education Foundation  
[www.cleanvehicle.org](http://www.cleanvehicle.org)

August 31, 2012



### Facility Modifications to Accommodate Work on CNG Vehicles











# KCATA SITE

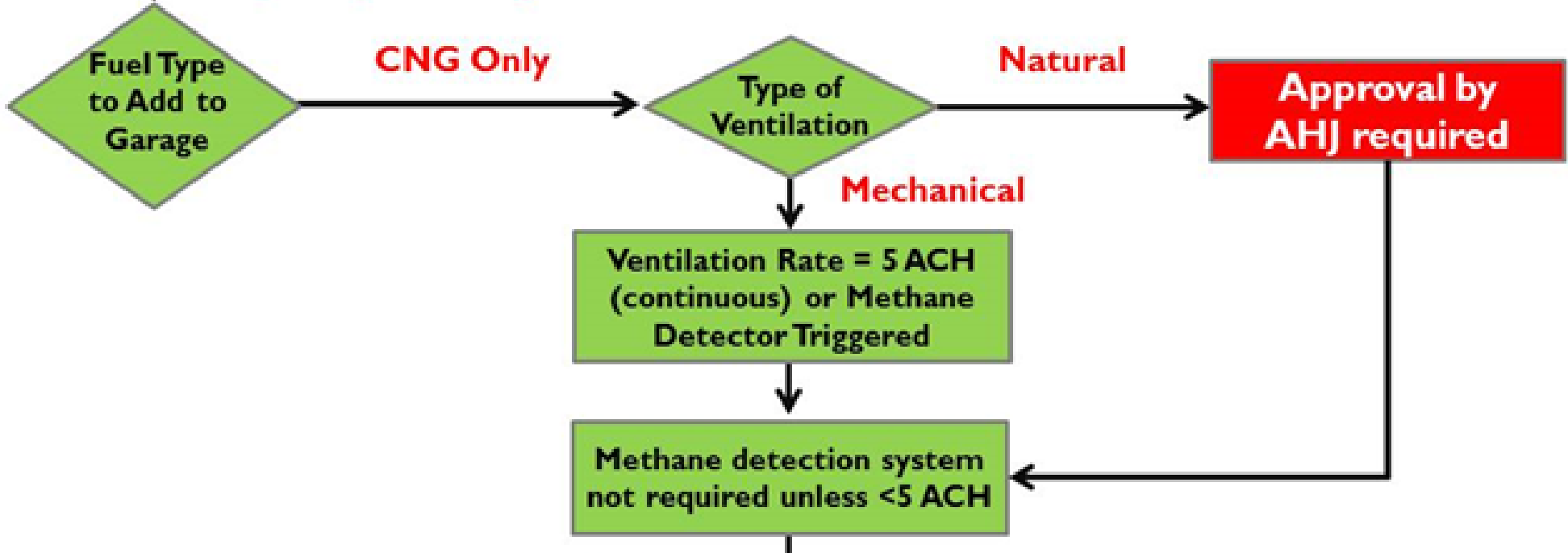
## LEGEND

-  Maintenance
-  Bus Storage
-  Bus Service (Fueling, Wash)
-  New CNG Transit Fuel Station





**Major Repair Garage**



## VESDA® VLI by Xtralis™



The VESDA VLI by Xtralis is an industry first early warning aspirating smoke detection (ASD) system, designed to protect industrial applications and harsh environments of up to 2000m<sup>2</sup> (20,000 sq. ft.).

### Long life, intelligent, fail-safe technology

The VLI detector combines a fail-safe Intelligent Filter (patent pending) with an advanced clean-air barrier for optics protection allowing the use of absolute detection and a long detection chamber life without the need for re-calibration.

The Intelligent Filter:

- effectively reduces the level of pollution in the air sample before it enters the detection chamber, which dramatically extends the operational life of the detector in harsh and polluted environments.
- is fully monitored, therefore providing consistent sensitivity over the entire operational life of the detector.

### Installation, Commissioning and Operation

The VLI detector features a robust IP54-rated enclosure which provides protection against dust ingress and water splash. In the majority of applications this eliminates the need to use expensive external IP enclosures, thus simplifying and reducing the cost of installation.

The VLI detector is equipped with a powerful aspirator that provides a total pipe length of 360m (1200 ft). It is fully supported by the Xtralis ASPIRE2, VSC and VSM4 software applications which facilitate ease of pipe network design, system commissioning and maintenance together with compatibility with existing VESDA installations.

The AutoLearn™ commissioning assistant reduces setup time and ensures optimum alarm and flow thresholds in a range of environments.

The VLI detector features a standardised industry BACnet over Ethernet communication protocol for remote monitoring and programming and connection to building management systems (BMS) and automation devices. This translates to direct cost savings on integration and monitoring.

The VLI detector is inherently less prone to nuisance alarms due to the intelligent filter, lint trap, sub-sampling probe and secondary filter. Coupled with its modular design, VLI offers a lower total cost of ownership over the life of the product.

## VLI-880, VLI-885

### Features

- Suitable for Class 1 Division 2 applications
- Groups A, B, C & D
- Up to 2000m<sup>2</sup> (20,000 sq. ft.) coverage
- Up to 4 inlet pipes
- Total pipe length up to 360m (1200 ft)
- Five (5) high intensity status LEDs for greater visibility
- Robust absolute smoke detection
- Intelligent Filter (patent pending)
- Lint Trap to capture fibrous particulates
- Sub-sampling Probe (inertial separator)
- Secondary Filter
- Clean air barrier for optics protection
- Referencing
- AutoLearn™ Smoke and Flow
- Clean Air Zero™
- Air-path monitoring
- Five (5) relays (Fire, Fault and 3 configurable)
- Relays configurable as latching or non-latching
- Expandable GPI and relays
- Ultrasonic flow sensing
- Xtralis VSC, Xtralis VSM4 and ASPIRE2 software support
- IP54 Enclosure
- Easy mounting through steel support bracket
- Modular field replaceable parts for ease of servicing
- BACnet over Ethernet
- Local USB configuration port
- Easy cable termination access
- Imperial and metric pipe ports
- Rubberized finish to external housing

### Listings / Approvals

- UL
- ULC
- FM
- ActivFire
- LPCB
- CE - EMC and CPD
- EN 54-20
  - Class C (60 holes / Fire-1 = 0.15% obs/m)
  - Class B (28 holes / Fire-1 = 0.15% obs/m)
  - Class A (24 holes / Alert = 0.06% obs/m)

Classification of any configuration is determined using ASPIRE2.

Regional approvals listings and regulatory compliance vary between VESDA product models. Refer to [www.xtralis.com](http://www.xtralis.com) for the latest product approvals matrix.

## VESDA ECO™ Detector

### Gas Detection for Use with Aspirated Smoke Detection

Xtralis the manufacturer of the market leading VESDA aspirating smoke detection (ASD) technology has developed the industry's first multi-hole aspirated gas detector.

When used with the VESDA range of ASD products; VESDA ECO provides the industry's 1st combine aspirated smoke and gas detection system.

VESDA ECO provides early warning of toxic, oxygen and flammable gas hazards to protect personnel and property whilst ensuring business continuity.

Applications include:

- Battery charging rooms
- Boiler plant rooms
- Commercial kitchens
- Parking garages
- Utility / service tunnels
- Refrigerated stores and plant rooms
- Water treatment and sewerage plants
- Power generation plants
- Metal processing plants
- and more...

### How It Works

VESDA ECO uses an existing or new VESDA aspirating pipe network to actively monitor for gas escapes and build-ups.

Each ECO gas detector can house up to two gas sensors, and additional detectors can be added easily to the VESDA pipe network to monitor more gases if required. Pre-calibrated sensor cartridges are easily replaced in the field and make converting to different gas sensors or replacing sensors a simple task.

The VESDA ECO detector is configured using Xtralis VSC configuration software and can be remotely monitored using Xtralis VSM4 monitoring software. Both VSC and VSM can be used to download data from the on-board memory card for data analysis and trending of historical data.

Integration with other building systems, including fire alarm control panels, PLCs, HVAC and building management systems, provides real-time situational awareness for intelligent emergency response.

VESDA ECO by Xtralis provides significant installation and routine maintenance cost savings over conventional multi-point gas detection solutions, by reducing the number of detectors required to cover an area and by providing easy access for routine maintenance.

Hazardous area certified variants of VESDA ECO are available (Approval pending).



## Gas Detection and Environmental Monitoring

### Features

- Toxic, Oxygen or Flammable gas detection
- Single or dual gas versions
- Factory calibrated sensor cartridges
- Integral alarm status LEDs
- Integrates with PLCs/HVAC/BMS/FACP
- Configurable relays
- 4-20 mA analog outputs
- RS485 Modbus output
- On-board event logging
- On-board fault diagnostics
- Integral gas test port
- Remote reset

### Approvals

CE

#### Electrical safety:

Conforms to ANSI/UL Std 81010-1  
 Certified to CAN/CSA Std C22.2 No. 81010-1  
 EN 81010-1

#### EMC:

FCC 47CFR Part 15B class B  
 ICES 003  
 EN 50270

#### Others:

LCPB, VdS, AFNOR compatible for use with Xtralis EN54-20 approved ASD

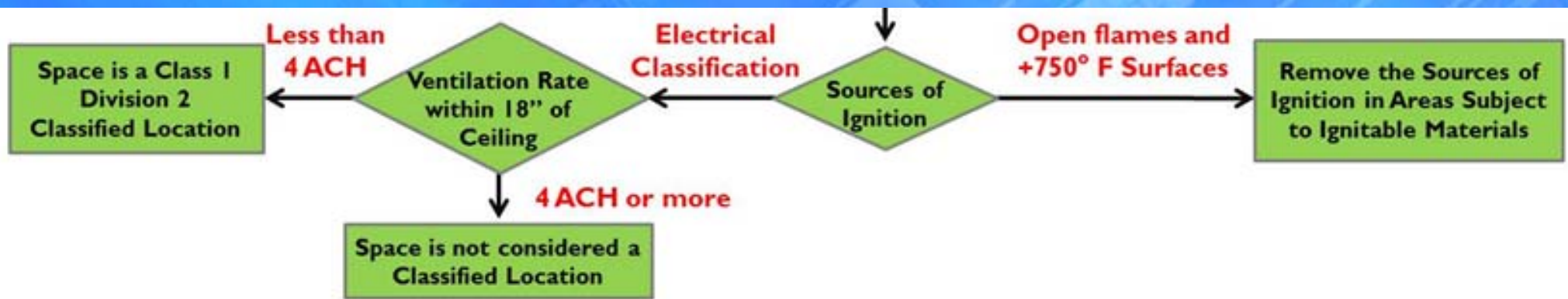
LOM approved to UNE 23300 (CO & CO+NO<sub>2</sub>)

AQISQ – CMC Pattern Approval  
 CCCF – CFE, GB:15322.1

VNIPO

Hazardous area, ATEX, ANSI/ISA, CSA (pending)

1) Consult with Xtralis if application requires removal of interferent gases.



## Lessons Learned

- Explosion Proof versus Spark Resistant AHU's
  - Use a belt driven plenum fan which is an aluminum fan wheel which won't spark if a failure creates contact between the housing and fan wheel.
  - Use an enclosed fan cooled (TEFC) motor so that the brushes and windings aren't exposed to the airstream versus an open drip proof (ODP).
- Air Sampling Filters
  - Require replacing more frequently while the diesel fleet is still in operation.

# ENGINEERING KANSAS CITY AREA TRANSIT AUTHORITY

*MID-AMERICA ALTERNATIVE FUEL CODES SUMMIT  
OCTOBER 29, 2014*



JAY R. GUERRA PE  
PRINCIPAL  
MECHANICAL ELECTRICAL & PLUMBING  
(816) 358-1790  
JGUERRA@GDSENGR.COM