Automatic Toxic Industrial Chemical, Chemical Warfare Agent and Radiological Detection System

1. General
   1.1. All sensors are physically connected as an "autonomous network" with the alarms and statuses of each sensor/detector able to be accessed in real-time through a centralized command and control as well as via the Internet if desired

   1.2. All the sensors are physically connected via CAT5/6 or fiber optic cabling to a central Programmable Logic Controller (PLC) Secure Backbone System with wireless capability

   1.3. The sensor data is processed by the Operator Interface Computer Workstation which is physically connected to the PLC Backbone System

   1.4. The Operator Interface Computer Workstation acts as a Human Machine Interface (HMI) and displays all sensor data in real-time

   1.5. The sensor system is a next-generation autonomous active detection system operating 24/7/365

   1.6. The sensor data is stored and maintained by the Operator Interface Computer Workstation by active and continuous interface with the PLC Backbone System

   1.7. Every sensor in the System will be individually labeled for quick and easy reference on the HMI

   1.8. The status of each sensor can be viewed in real-time

   1.9. The System employs dry contacts or digital means for direct connection with the existing Building Management System (BMS) for certain post detection CONOPS plans such as closing outside air dampers, activating a NBC filtration system and notifying management and first responders

   1.10. The system will include all needed software, hardware and programming to enable immediate use once installed

2. System Description and Components
   2.1. System Main Components:
      2.1.1. Toxic Industrial Chemical (TIC) Detector Module

      2.1.2. Chemical Warfare Agent (CWA) Detector Module

      2.1.3. Spectroscopic Radiological Area Detector (RAD) Module

      2.1.4. Autonomous Programmable Logic Controller (PLC) Network Interface Module

      2.1.5. Detection Software Platform

2.1.6. Operator Interface Computer Workstation/s

2.2. System Description:

2.2.1. Detection Point Locations:

2.2.1.1. The sensors and detectors are located inside and outside the venue according to site requirements and engineering assessment. The main area to be protected is the critical facility. Examples of detection points may be as follows:

2.2.1.1.1. Any outside fresh air streams located throughout the facility, any return air streams that may come from less protected areas, roof fans and physical access points, critical & shelter rooms, loading docks and entrance / lobby areas

2.2.2. Toxic Industrial Chemical (TIC) Detection Module

a) Detector module technology is based on proven very, very low false alarm rate architecture
b) Detector module technology is based on a redundant "dual sensor engine" design
c) Detector module utilizes best of breed Electro-Chemical sensors
d) Detector module utilizes redundant sample air pumps
e) Detector module utilizes an external sample air filter design for quick and low cost of maintenance
f) Detector module does not require any consumables other than the external sample air filter
g) Detector module is designed for 24/7/365 continuous use with a 48 month life cycle
h) Detector module is designed for "refurbishing" after the initial 48-month period
i) Detector module utilizes IP-67 connections for quick yet secure removal and re-installation
j) Detector module requires only a 24-month calibration check
k) Detector module plugs directly into the PLC Autonomous Backbone Network
l) Detector module detects the following <u>Toxic Industrial Chemicals:</u>
    i. Acetone
    ii. Acetylene
    iii. Acrolein *
    iv. Acrylonitrile *
    v. Ammonia
    vi. Arsine
    vii. Bromine
    viii. Carbon Monoxide
    ix. Chlorine
    x. Chlorine Dioxide
    xi. Chlorine Trifluoride
    xii. Cyanogen Chloride
    xiii. Diborane
    xiv. Ethane

xv. Ethylene
xvi. Ethylene Oxide *
xvii. Fluorine
xviii. Formaldehyde *
xix. Germane
xx. Hydrogen
xxi. Hydrogen Bromide
xxii. Hydrogen Chloride
xxiii. Hydrogen Cyanide
xxiv. Hydrogen Fluoride
xxv. Hydrogen Sulfide
xxvi. Iodine
xxvii. Methanol
xxviii. Nitrogen Dioxide
xxix. Nitrogen Trifluoride
xxx. Nitric Oxide
xxxi. Ozone
xxxii. Phosphine
xxxiii. Siline
xxxiv. Sulfur Dioxide
xxxv. Toluene

* Included when the CWA Module is utilized in conjunction with TIC module.

2.2.3. Chemical Weapon Agents (CWA) Detection Module

a) Detector module is based on proven Metal Oxide Intelligent Nano Array Sensor (iNAS) technology
b) Detector module has widespread use within the US Military, DOD and US Department of Homeland Security
c) Detector module utilizes an external sample air filter design for quick and low cost of maintenance
d) Detector module does not require any consumables other than the external sample air filter
e) Detector module is designed for 24/7/365 continuous use with a 4-5 year life cycle
f) Detector module is designed for "refurbishing" after its lifecycle period
g) Detector module utilizes IP-67 connections for quick yet secure removal and re-installation
h) Detector module requires only a 24-month calibration check
i) Detector module plugs directly into the PLC Autonomous Backbone Network
j) Detector module detects the following <u>Chemical Weapon Agents:</u>
    i. Lewisite
    ii. Mustard
    iii. Phosgene
    iv. Sarin
    v. Tabun

vi. VX
vii. Cyanogen Chloride
viii. Hydrogen Cyanide

2.2.4. Spectroscopic Radiological Area Detector (RAD) Module

a) Detector module is comprised of a 3" Sodium Iodide (NaL) scintillator
b) Detector module utilizes patented Quadratic Compression (QCC) and time-slicing and pattern-recognition techniques
c) Detector module has the capability for Isotope-specific and total dose rate reporting
d) Detector module has the capability for Special Nuclear Material (SNM) detection with optional enhanced neutron detection
e) Detector module has the capability for indication of multiple radionuclides concurrently within one second (real time) at dose rates well below 1 µRem/hr
f) Detector module has user extensible nuclide library of over 100 isotopes
g) Detector module utilizes multiple identification techniques including peak fitting, least squares analysis, and expert-systems approaches
h) Detector module has TCP/IP networking with built-in file transfer (TFTP) and email (SMTP) protocols
i) Multi-unit installations are easily configured using the autonomous PLC backbone
j) Detector module has the capability to transmit spectra data in ANSI N42.42 (Homeland Security) compliant format
k) Detector module self-calibrates for background NORM and signal drift
l) Detector module utilizes automatic background updates for reduced maintenance and noise
m) Detector module utilizes calibration stabilization
n) Detector module utilizes IP-67 connections and is housed in a watertight housing for use in all weather conditions
o) Detector module plugs directly into the PLC Autonomous Backbone Network
p) Detector module <u>detects and identifies the following Isotopes</u>:

i. **Default:**
Co60 Ga67 Tc99m Cs137 Ir192m Ra226 U235 U238 Am241

ii. **Database:**
C11 N13 F18 Na22 Na24 K40 K42 K43 Sc46 V48 Cr51 Mn52 Mn54 Fe52 Fe59 Co55 Co57 Co58 Co60 Cu64 Cu67 Zn65 Zn69m Ga67 Ga72 As72 As74 As76 Se75 Br77 Rb81 Rb84 Sr85 Sr89 Y86 Y88 Mo99 Tc99m Pd103 Cd109 In111 In113 Sb122 Sb124 Sb125 I123 I124 I125 I129 I130 I131 I133 Xe133 Cs134 Cs137 Ba133 Ba137 Ce144 Sm153 Eu152 Eu155 Yb169 Ir192 Au198 Au199 Hg197 Hg203 Tl201 Tl204 Tl208 Pb203 Pb210 Pb212 Pb214 Bi207 Bi212 Bi214 Ra224 Ra226 Ac228 Th232 Th234 Pa234 U233 U235 U238 Np237 Pu238 Pu239 Am241

iii. **ANSI N42.34 isotopes:**
K40 Co57 Co60 Ga67 Tc99m I125 I131 Ba133 Cs137 Ir192 Tl201 Ra226 Th232 U233 U235 U238 Pu239 Am241

iv. **Industrial isotopes:**
Co57 Co60 Ba133 Ba133s Cs137 Ir192 Tl204 Am241 Th232

v. **Medical isotopes:**
F18 Cr51 Ga67 Se75 Sr89 Mo99 Tc99m Pd103 In111 I123 I125 I131 Xe133 Sm153 Tl201

vi. **SNMs:**
U233 U235 Np237 Pu238 Pu239

2.2.5. Autonomous Programmable Logic Controller (PLC) Network Interface Module

a) PLC network interface module provides for an autonomous secure network for all sensors on the network and report in real-time
b) PLC network interface module is comprised of COTS based industry leading Allen Bradley componentry
c) PLC network interface module allows for secure communication between any and all sensors, sensor networks and associated systems ex: chemical, explosive, biological, radiation, NBC filtration, fire, smoke, water and various analytics systems
d) PLC network interface module allows for virtually any desired digital or analog device to report onto the autonomous network
e) PLC network interface module can be used to securely connect to different types of communication platforms to enable a view into the system from virtually any device anywhere in the world
f) PLC network interface module has FULL SCADA capability as well as other advanced DDC system integration requirements
g) PLC network interface module can offer real-time monitoring capability
h) PLC network interface module provides both electronic and dry contact outputs for actionable CONOPS post event
i) PLC network interface module has an onboard Uninterrupted Power Supply (UPS)
j) PLC network interface module continuously runs self-diagnostics in real-time
k) PLC network interface module communicates directly with the Operator Interface Computer
l) PLC network interface module can be outfitted with virtually any form of wireless communications

2.2.6. Detection Software Platform

a) Detection Software Platform is installed on the Operator Interface Computer and is based on Windows 7 Professional
b) The Detection Software Platform monitors the operation of the entire detection system
c) The Detection Software Platform allows for multi-level password protected access based on individual restrictions
d) The Detection Software Platform allows for different trigger levels of all individual sensors

e) The Detection Software Platform allows for bypassing any failed component to allow for maximum up-time while repairs are being completed
f) The Detection Software Platform stores all alarm history of the entire system and may allow for trending of certain sensors
g) The Detection Software Platform communicates directly with the PLC network module and is part of the secure network
h) The Detection Software Platform allows for data transfer between the sensors via the PLC network module on a continuous basis in real-time
i) The Detection Software Platform is scalable to other peripheral devices

2.2.7. Operator Interface Computer Workstation

a) The Operator Interface Computer is the Human Interface Machine (HMI) to the entire detection system which allows for a visual representation of:
    i. Individual and addressed sensor trigger levels
    ii. Real-time sensor output data
    iii. Real-time system and operational data
    iv. Maintenance requirements
    v. Alert and alarm data
    vi. Bypass of systems information
    vii. Alarm history
    viii. Analytics ready (if used)
b) The Operator Interface Computer is protected via multi-layered password inscription with individual restricted access
c) The Operator Interface Computer is the data gateway to other peripheral devices
d) The Operator Interface Computer utilizes external Uninterrupted Power Supply (UPS)