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AccuSense® FAQ

May 2010

AccuSense Frequently Asked Questions (FAQs)

1. **What is AccuSense?** *AccuSense is a laboratory-quality chemical recognition system that provides concentration levels of multiple chemicals simultaneously in a field-portable or fixed-position format.*

2. **Who was AccuSense designed for?** *AccuSense was designed for end users by end users. Every design element is implemented for a reason. The result is an accurate, field-portable, easy-to-use detection device that can be used for point detection applications or for fixed network continuous monitoring applications.*

3. **What types of deployment scenarios is AccuSense intended for?** *AccuSense is intended to be deployed in a variety of scenarios, but the most common would be a multiple-unit deployment in the area of a known chemical release. The units would be set in and around the anticipated "hot zone," allowed to run for any period of time, and the information would be transmitted wirelessly back to a command post. The information gathered would be used to define the "hot" and "cold" zones and to set up a perimeter for public and worker safety. In addition, multiple AccuSense units can be placed in an industrial setting and run continuously to monitor concentrations of chemicals and provide the user with the proper information to make decisions about worker safety.*

4. **What type of technology is used?** *Dual-Hyphenated Gas Chromatography (DHGC) for separation of chemicals and a thermal detection system for chemical identification.*

5. **What is DHGC?** *DHGC is a unique form of Gas Chromatography that utilizes two columns to perform separation of polar and non-polar chemicals.*

6. **What chemicals does AccuSense detect?** *AccuSense detects a wide variety of organic and inorganic Toxic Industrial Chemicals (TICs) such as hydrogen chloride, sulfur dioxide, ethylene oxide, phosgene, and many more.*

7. **Does AccuSense detect explosive compounds?** *Currently, AccuSense has the capability to detect, identify, and quantify chemical concentrations of explosive precursors in the gaseous state, such as hydrogen chloride. The principles behind the detection of solid explosives such as RDX or TNT, however, involve the capture and vaporization of particulates. The technology behind AccuSense can easily be modified to include the capture and vaporization of particulates, but is not included in the product line at this time.*

8. **What database does AccuSense compare its results to for identification?** *AccuSense does not utilize a published comparison database, such as the NIST Mass Spectral Library that may be used in a GC/MS device. Instead, AccuSense utilizes proprietary neural network algorithms that operate similar to a fingerprint identification system.*

9. **How long does it take for AccuSense to collect a sample, analyze it, and display the results?** *AccuSense runs on a 3-minute analysis cycle time that is not currently able to be modified by the user. The "Auto-Refresh" capability at the PC level allows the user to see new chemical concentration results every three minutes.*

10. **What happens to results in the presence of environmental confusers such as diesel fumes, firefighting foam, etc.?** *Due to the separation capabilities in the DHGC technology and the neural network algorithms that are the backbone of the identification process, AccuSense is essentially blind to environmental confusers and will hence not report false positives or false negatives in their presence.*

11. **What are the detection limits of AccuSense?** *The detection limits of the device will vary chemical to chemical, but in general the detection limits are in the low parts-per-million (ppm) range, with the ability to detect all chemicals within the database below its respective Immediately Dangerous to Life and Health (IDLH) level.*

12. **What is the battery life of the device?** *The upper field-portable portion of the AccuSense device will run continuously in most operating environments for a minimum of 8-hours. If additional battery life is needed, the bottom power module can be added seamlessly in the field for an additional 8-hours of battery life.*

13. **What is the battery recharge time?** *AccuSense has a trickle charger that continuously recharges the main battery when the AccuSense is plugged into AC power. Additionally, the battery charger will charge a depleted battery within a 6-7 hour timeframe.*

14. **Is there an A/C power option?** *Yes, when deploying a fixed AccuSense network or when AC power is available to support your application you can attach the AccuSense AC power brick to support continuous operations.*

15. **How does AccuSense respond in the presence of high humidity conditions?** *Due to the way that the AccuSense device handles data, the presence of high humidity conditions does not affect the performance of the unit. Essentially, the neural network identification algorithms treat water vapor as an additional chemical and its presence, whether in low or high quantities, is insignificant.*

16. **How does AccuSense communicate results to the user?** *AccuSense operates using either a direct plug-in Ethernet cable that attaches from the device to a laptop PC or through a wireless network in which a master radio at the PC communicates to the units. Currently, 900 MHz and 2.4 GHz installations are available.*

17. **How does the software communicate results to the user?** *At the laptop PC level, the user will be notified of chemicals that are detected and their concentration levels relative to IDLH. A color-coded representation on a sliding bar scale along with visual flashing will notify the user that a chemical concentration detected is dangerous. At the unit itself, visual light-emitting diodes (LEDs) will notify the user of the hazard level of the chemical(s) detected (High, Medium, Low).*

18. **How many Accusense units can be monitored at one time from a single PC?** *Currently, up to eight AccuSense devices can be monitored simultaneously from one PC.*

19. **What is the exterior AccuSense case made of?** *The housing of the AccuSense device is made out A356 aluminum, which allows for easy decontamination after operation in the "hot zone" and allows for operation in a wide variety of environments.*

20. **How does AccuSense remove the requirement for consumables?** *The lack of consumables on the AccuSense device is primarily due to the use of conditioned ambient air as an elute gas source. Since ambient air is used, there is no need for inert gas canisters that would add weight to the device, would require human intervention in the "hot zone,' and would hinder the ability of the device to run continuously for extended periods of time.*

21. **What happens to the operation of the device in the presence of extremely corrosive chemicals?** *AccuSense will detect, identify, and quantify chemical concentrations of corrosive chemicals such as hydrogen chloride, chlorine, etc. without problem due to extensive engineering work done in the material compatibility area. If the device is placed in an atmosphere where*

highly corrosive chemicals are present at extremely high concentrations for extended periods of time, however, there is a chance that these unique circumstances could cause mechanical failure within the device. The important point to note is that the AccuSense device will appropriately warn the user of the hazards present prior to corrosive failure.

AccuSense TICs Unit - Core 21 Chemical Signature Database

Acetone	Ethyl Ether	Methylene Chloride
Acrolein	Ethylene Oxide	Nitroethane
Acrylonitrile	Formaldehyde	Phosgene
Benzene	Hydrogen bromide	n-Propanol
n-Butanol	Hydrogen chloride	Sulfur Dioxide
Carbon Disulfide	Isopropyl Alcohol	Toluene
Chlorine	MEK	Trichloroethylene

AccuSense Main Chemical List – Reasons for Concern

1. **Acetone** – More than 3 million tons produced annually, mainly as a precursor for polymer production. The main hazard associated with acetone is its flammability due to its flash point of -4F. (IDLH = 2500 ppm)
2. **Acrolein** – Used in production of many polymers. Severe pulmonary agent and was used as a chemical weapon in World War I. Extremely toxic at low concentrations. (IDLH = 2ppm).
3. **Acrylonitrile** – Used in production of synthetic polymers. Highly flammable and toxic, burning releases hydrogen cyanide fumes. (IDLH = 85 ppm)
4. **Benzene** – Industrial solvent used as an intermediate in the production of plastics, rubber, and dyes. Natural constituent of crude oil. Known carcinogen. Damages bone marrow and causes a decrease in red blood cells. (IDLH = 500 ppm)
5. **Butanol (butyl alcohol)** – Used as an industrial intermediate in the production of butyl acetate. Present naturally in many food and beverages. Toxicity is relatively low. (IDLH = 1400 ppm)
6. **Carbon Disulfide (CS2)** – Industrial use in the production of viscose rayon fibers. Potential life-threatening effects on the nervous system. (IDLH = 500 ppm)
7. **Chlorine (Cl2)** – As the chloride ion, abundant in nature (common salt). In its elemental form, powerful oxidant used in the chemical industry. Used as a chemical weapon in World War I and the Iraq War. Irritates the respiratory system. When inhaled at high concentrations, reacts with water and turns into hydrochloric and hypochlorous acid. Heavier than air and tends to accumulate in poorly ventilated spaces. (IDLH = 10 ppm)
8. **Ether** – Important solvent used in the manufacture of cellulose plastics. Starting fluid for gasoline and diesel engines. Formerly used as an anesthetic. Extremely flammable. (IDLH = 1900 ppm)

9. **Ethylene Oxide (EtO)** – Main precursor to ethylene glycol and other high-volume manufactured chemicals. Also used in sterilization of medical products. Typically handled and shipped as a refrigerated liquid. Precursor to mustard gas. Inhalation hazard and known carcinogen. (IDLH = 800 ppm)
10. **Formaldehyde** – Important industrial chemical used in the production of paints, resins, and explosives (RDX). Also used in embalming process. Toxic, allergenic, and carcinogenic. (IDLH = 20 ppm)
11. **Hydrogen Bromide (HBr)** – a gas at standard conditions, NOT the same as hydrobromic acid. Used in the manufacture of inorganic bromides for use in photography, pharmaceuticals, fire retardants, and other chemical processes. Extreme eye, skin, and mucous membrane irritation may result from exposure. (IDLH = 30 ppm).
12. **Hydrogen Chloride (HCl)** – Refers to the gaseous state, not the liquid state hydrochloric acid. Most often used in the production of hydrochloric acid, also an important reagent in hydrochlorination of rubber and production of vinyl chlorides. Severe respiratory irritant and may cause permanent burns to the eyes. (IDLH = 50 ppm)
13. **Isopropyl Alcohol (IPA)** – Relatively non-toxic solvent used primarily as a cleaning fluid. Primary hazard is due to its flammable properties. (IDLH = 2000 ppm)
14. **Methyl Ethyl Ketone (MEK, 2-butanone)** – Solvent used in the manufacture of plastics, textiles, and paraffin wax. An irritant, but not extremely toxic. (IDLH = 3000 ppm)
15. **Methylene Chloride (MeCl2, dichloromethane)** – Solvent used as a degreaser or paint stripper. Acute inhalation hazard due to its volatility. Potentially carcinogenic. (IDLH = 2300 ppm)
16. **Nitroethane** – Organic compound used in the chemical manufacturing industry. Additional uses as a fuel additive and precursor to explosives. Suspected to cause genetic damage and is harmful to the nervous system. (IDLH = 1000 ppm)
17. **Phosgene (COCl2)** – Used as a chemical weapon in World War I. Used in production of isocyanates, which are in turn are used to manufacture polyurethanes. Also used in production of polycarbonates. Gaseous chemical spills of phosgene can be counteracted with ammonia. Extremely toxic poison and choking agent. (IDLH = 2 ppm)
18. **Propanol (n-propanol)** – Relatively non-toxic solvent used in the pharmaceutical industry. (IDLH = 800 ppm)
19. **Sulfur Dioxide (SO2)** – Intermediate in the production of sulfuric acid. Primarily released from the combustion of fossil fuels and volcanic emissions. Strict environmental regulations due to its role in acid rain. Eye, skin, and mucous membrane irritant. (IDLH = 100 ppm)
20. **Toluene** – Common solvent used in many chemical reactants, rubber, adhesives, and disinfectants. Raw material used in production of TNT. Can be used as an octane booster in gasoline fuels. Toxicological effects on the nervous system. (IDLH = 500 ppm)
21. **Trichloroethylene (TCE)** – Dry cleaner solvent and degreaser for metal parts. Exposure causes nervous system depression and anesthesia. Can react with CO2 to form phosgene. Prime groundwater/drinking water contaminant. Nervous system irritant. (IDLH = 1000 ppm)