FACILITY AND VENUE PROTECTION

INTRODUCTION

In late 2001, the Department of Homeland Security was created to "develop and coordinate the implementation of a comprehensive national strategy to secure the United States from terrorist threats or attacks." As part of this comprehensive strategy, there is an increasing world focus on building and special-venue protection. The chemical and radiation detection equipment designed and manufactured by RAE Systems is ideally suited for rapid, scalable, and highly adaptable deployment at a wide variety of locations that require additional security against terrorist threats or industrial accidents. Following is a description of the most effective methods of deployment for gas and radiation detection equipment as well as what steps should be taken immediately after an alarm is triggered.

CBRN Sensors

RAE Systems offers a variety of chemical, biological, radiological, or nuclear (CBRN) sensor solutions. The most complete package is the AreaRAE Gamma, a wirelessly enabled 4-gas monitor (PID/LEL/O_2/Toxic or PID/LEL/Toxic1/Toxic2) combined with a gamma radiation sensor. GPS is also available for this monitor. The PID (photoionization detector) gives early warning for a variety of organic vapors that might be of concern, such as gasoline, pepper spray and some chemical warfare agents. The LEL sensor is useful for detecting most combustible gases such as hydrogen, propane, and methane. Many people consider the oxygen sensor as the ultimate broadband detector. As little as a 1% deficiency in atmospheric oxygen levels can be life-threating. The toxic gas sensors can be chosen from any of the following: CO, H_2S, SO_2, NO, NO_2, Cl_2, HCN, NH_3, or PH_3.

In addition to the AreaRAE Gamma, RAE Systems offers other CBRN sensors such as the 5-gas AreaRAE, the 5-gas MultiRAE Plus, the ppbRAE Plus PID, and the MiniRAE 2000 PID. All of these portable monitors can also be wirelessly enabled by using a RAELink modem.

Figure 1. AreaRAE Gamma Wireless Monitor with GPS.

By linking these individual sensors together into an array it becomes possible to monitor multiple locations simultaneously from one centralized location. RAE Systems offers a rapidly deployable and custom-configurable sensor solution where all monitors are wirelessly enabled and can transmit data to a centralized command station up to two miles away. RAE Systems ProRAE Remote software is capable of managing wireless transmissions from up to 32 individual monitors. If more sensors are required, users can deploy RAE Systems' AreaConnect 500 server product, which can aggregate data from over 256 individual monitors and post the real-time data to a secure website.

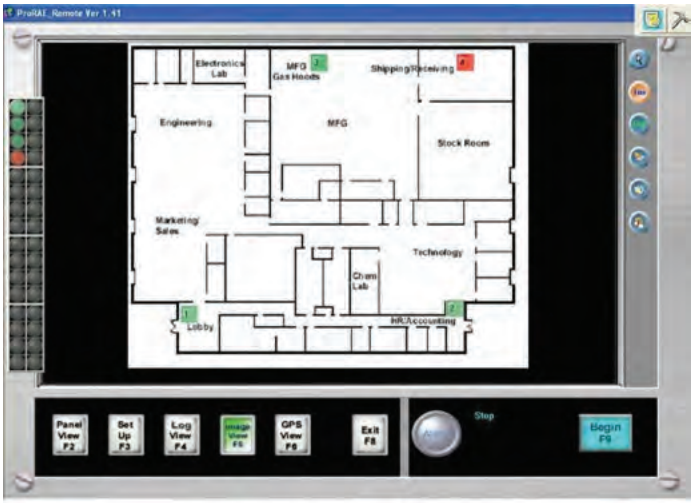

Figure 2. ProRAE Remote monitoring software.

COMBINE PREVENTIVE MEASURES AND SENSOR ARRAYS

Determining the level of risk of a CBRN attack or accident at any given location is extremely difficult. However, there are several preventive measures that building owners and operators can take that reduce the likelihood of a CBRN event occurring at their location. In addition, should an event occur, the strategic use of CBRN sensors throughout the building can significantly help mitigate the damage and provide emergency personnel with life-critical data as they direct building occupants to safety.

Preventive Measures

1. **Know your building.** The quickest way for airborne CBRN agents to disperse through a building is through the heating/ventilation/air conditioning (HVAC) system. It is extremely important that facility managers and security personnel have a thorough understanding of the building's air circulating zones and how to alter or disable the system if necessary.
2. **Prevent access to outdoor air intakes.** The National Institute for Occupational Safety and Health (NIOSH) recommends that HVAC air intakes be placed a minimum of 12' above the ground and have a metal mesh cover angled at a minimum of 45° to prevent foreign objects from entering the HVAC system. (See Figure 3.) Air intakes are also an ideal spot for CBRN sensors. A sensor placed at a building's air intake gives the earliest possible warning to security personnel of an outside CBRN threat.

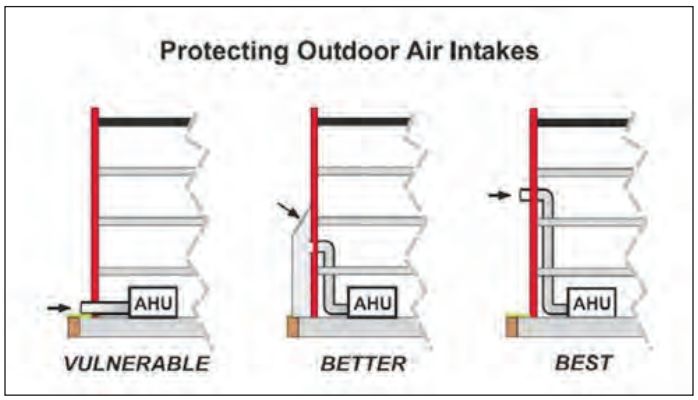

Figure 3. Outdoor HVAC air intakes (NIOSH).

3. **Prevent access to HVAC equipment and building plans.** Personnel with access to the mechanical HVAC equipment have full control of the building's air supply. Similarly, building plans with information such as how many ventilation zones the building has, and which air vents serve which rooms, should be kept in a safe, secure location with highly restricted access. HVAC equipment rooms are also ideal locations for CBRN sensors, as more air passes through these areas than anywhere else in the building.

Figure 4. AreaRAE monitoring mechanical equipment.

4. **Develop and train an emergency response team.** A team of people with well-defined responsibilities should be created to ensure a safe and orderly response to a CBRN event. Some key responsibilities that need to be designated are: contacting the local fire department, shutting off or manipulating the building HVAC system, directing building occupants to the safest locations, communicating the CBRN sensor array data to emergency personnel, and coordinating first aid. Part of the emergency response training should include planning and practicing a typical response to a CBRN event.

Deploying CBRN Sensors

The quickest, safest and most accurate way to detect a chemical, biological, radiological, or nuclear threat is by using sensors. For facility and venue protection, several key areas should be monitored. As with any sensor array, the level of detection is largely determined by the overall number of sensors in the array. At a minimum, RAE Systems recommends that the following locations within a facility or venue be monitored with CBRN sensors:

- **HVAC outdoor air intakes.** The air intake system of a building offers the first response of any outside threat.
- **HVAC return air grilles.** Similar to outdoor air intakes, these internal grilles are used by the HVAC system to recirculate air within a building. If a CBRN event occurs close to a return air grille, there is risk of contaminating the entire building.
- **HVAC exhausts.** If a CBRN event occurs anywhere inside a building, a portion of the contaminant will eventually reach the building exhaust. In addition, in certain weather conditions, building exhausts can actually intake air into the HVAC system.
- **Mechanical areas.** These areas provide access to centralized mechanical systems, including filters, air handling units, and possibly boilers and water filtration units.
- **Lobbies and entryways.** Areas of buildings with public access are at greater risk for a CBRN event.
- **Densely populated areas.** Response time is critical for these areas, and a direct reading immediately followed by the sensing monitor's visual and audible alarms is the quickest way to inform nearby occupants of possible danger.
- **Mailrooms.** Due to the large amount of unknown packages entering the building, mailrooms are highly susceptible to terrorist threats.
- **Loading docks.** Areas where large packages enter the building should always be monitored.
- **Storage areas.** These areas provide ample space and are rarely monitored by security personnel. This makes storage areas an attractive target for CBRN events.
- **Stairwells.** Stairwells are typically used as the primary evacuation route for occupants on higher floors. It is important that any escape path is monitored for safety during an evacuation.

RAE Systems Sensor Array Deployment Examples

In addition to permanent detection systems at oil refineries, chemical plants, and government buildings, RAE Systems sensor arrays are often used for quick installation at temporary venues involving large groups of people, where a terrorist attack is of concern. For example, AreaRAE systems have been used at:

- 2002 Salt Lake City Olympics
- 2002 National League Baseball Playoffs
- 2003 Major League Baseball All-Star Game
- 2003 US Open Golf Championship
- 2003 Missouri Governor's Inauguration
- 2004 Republican National Convention
- Multiple Buffalo Sabres Hockey Games
- TOPOFF II Simulated Terrorist Attack Training Events in Seattle and Chicago

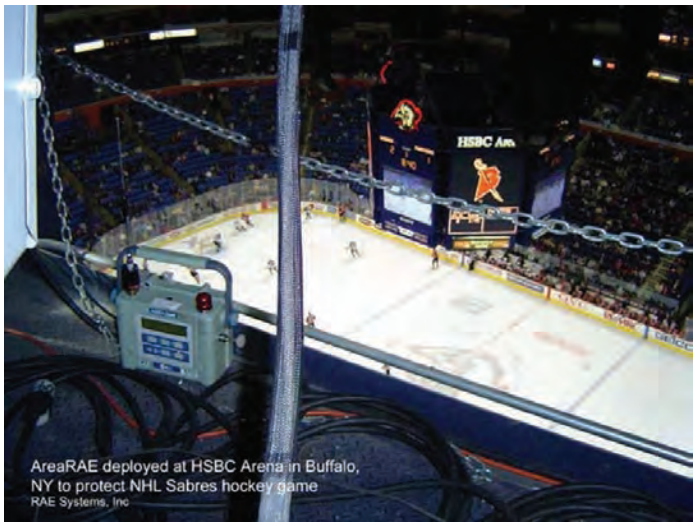

Figure 5. HSBC Arena during Buffalo Sabres hockey game.

Figure 6. Instrument calibration at the 2003 Major League Baseball All-Star game.

ACTIONS TO BE TAKEN IF AN ALARM IS TRIGGERED

Once an alarm is triggered, decisions must be made that will ensure the safety of the maximum number of building occupants. Responses to different alarms will vary greatly, depending on the location and nature of the alarm. Below are general guidelines that should be followed in the event of a sensor alarm.

1. Validate the alarm

False alarms are not only costly and time consuming, but as the number of false alarms increases, the sense of urgency is diminished and, as a result, emergency response times suffer. For this reason it is extremely important to validate any alarm that is triggered. There are several ways to validate a CBRN alarm. The first step for RAE Systems monitors is to see whether the alarm is sustainable. If the monitor returns to normal operation after only a few seconds of alarm status, the alarm can most likely be attributed to a temporary atmospheric condition or a system malfunction. Even after a "false" alarm, it is necessary to inspect the sensor location. Using ProRAE Remote's "Image View" display allows maintenance or safety personnel to pinpoint the location of the alarmed monitor. Portable handheld monitors, such as a MultiRAE Plus, ppbRAE Plus, or MiniRAE 2000 should always be used by security personnel when approaching a recently alarmed monitor. If the portable monitors show no readings, it is safe to inspect and/or repair the alarmed monitor.

2. Alert local authorities.

If a triggered alarm is real and sustainable, the first step is to immediately alert the local authorities, typically the fire department or local HazMat team. When alerting the fire department, it is important to identify the type of alarm, as this will allow the emergency responders to be better prepared and will help them identify the proper equipment to bring with them to the event location. The ProRAE Remote software identifies the alarm and location and communicates to building security personnel both audibly and visually when an alarm has been triggered. ProRAE Remote can also send emails or text messages to the proper personnel.

3. Adjust the HVAC system.

Once the proper authorities have been alerted and additional help is on the way, the next step is to adjust the building's HVAC system to minimize the spread of the CBRN contaminant. Adjustments to the building HVAC equipment should only be performed by someone who is properly trained and who understands the system thoroughly. Any improper adjustments could result in increased injuries or casualties.

For an outdoor CBRN event, the first indication of danger would typically come from a sensor deployed at the building's HVAC air intakes. A "protect in place" strategy should be deployed as building occupants will be safer inside the building than they would be if they were evacuated outside where the CBRN event occurred. When a monitor at an HVAC air intake is triggered, security personnel should direct all building occupants to stay indoors and immediately shut off all of the building's HVAC systems. All doors or windows that lead outside should be closed and all internal doors should be shut as well to minimize airflow inside the building. Also, elevators need to be disabled, because they can create a piston effect that causes contaminated air from outside to be drawn indoors. Building occupants should gather in a pre-identified location, typically a room that has little to no air exchange with the outdoors or the rest of the building.

For an indoor CBRN event, the first indication of danger would come from a sensor located in close proximity to the event or from a sensor located at an HVAC return air grille. Using ProRAE Remote software, a building operator can determine in which area of the building the event occurred and adjust the HVAC controls accordingly. The most effective HVAC settings would be

to set the air handling unit (AHU) in the contaminated area to full exhaust, while setting all other AHUs to supply 100% fresh air (no recirculation of contaminated air). The contaminated area will then draw air from the freshly supplied uncontaminated areas of the building while exhausting the contaminated area. If this type of manipulation is not possible, the second most effective HVAC settings would be to set all AHUs to supply 100% outdoor air (no recirculation). This will stop contaminants from spreading to other areas of the building through the HVAC system, but will not prevent dispersion through the natural air currents and pressure differentials throughout the building.

4. Instruct occupants to safe locations.

After HVAC manipulations are performed, the next and most crucial step is to instruct all building occupants to the safest locations.

For an outdoor CBRN event, building occupants should gather in a pre-identified indoor location, typically a room that has little to no air exchange with the outdoors or the rest of the building.

For an indoor CBRN event, building occupants should be evacuated if the escape route is shown to be free of contaminants. A sensor placed in a stairwell or by emergency exits can typically verify the safety of the escape route. Many buildings have equipment that can pressurize the stairwells with outdoor air, as this is a standard fire safety technique. Once outdoors, security personnel should direct occupants to gather at a pre-defined location that is upwind from the CBRN event. Portable monitors should also be used at gathering points to ensure each location is free from CBRN contaminants.

FURTHER INFORMATION

For further information on RAE Systems CBRN monitors and senor arrays, visit www.raesystems.com.

For further information on how to safeguard buildings from CBRN events and how to respond to CBRN events, please reference the following documents:

National Institute for Occupational Safety and Health (NIOSH), *Guidance for Protecting Building Environments from Airborne Chemical, Biological, or Radiological Attacks, 2002.*

Lawrence Berkeley National Laboratory, *Protecting Buildings from a Biological or Chemical Attack: Actions to Take Before or During a Release, LBNL/PUB-51959, 2003.*

US Army Corps of Engineers Protective Design Center, *Protecting Buildings and Their Occupants from Airborne Hazards, Technical Instruction 853-01, 2001*