Homeland Security
Science and Technology

# TechNote

U.S. Department of Homeland Security
SAVER
System Assessment and Validation for Emergency Responders

The U.S. Department of Homeland Security (DHS) established the System Assessment and Validation for Emergency Responders (SAVER) Program to assist emergency responders making procurement decisions.

Located within the Science and Technology Directorate (S&T) of DHS, the SAVER Program conducts objective assessments and validations on commercial equipment and systems and provides those results along with other relevant equipment information to the emergency response community in an operationally useful form. SAVER provides information on equipment that falls within the categories listed in the DHS Authorized Equipment List (AEL).

The SAVER Program is supported by a network of technical agents who perform assessment and validation activities. Further, SAVER focuses primarily on two main questions for the emergency responder community: "What equipment is available?" and "How does it perform?"

For more information on this and other technologies, contact the SAVER Program Support Office.

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NUSTL



## Environmental (Weather) Surveillance Equipment

*Environmental (weather) surveillance equipment, including both fixed and portable weather stations, can provide information needed by first responders during chemical, biological, radiological, nuclear, and explosive (CBRNE) emergencies involving the release of hazardous materials into the atmosphere, particularly in or near population centers. Weather surveillance equipment measures conditions at the incident site, knowledge of which is needed to assess risks, establish exclusion zones, protect downwind populations (i.e., evacuate or shelter-in-place), position incident command posts, and develop plans of action. First responders can be alerted to possible adverse changes in weather, such as the imminent arrival of a violent thunderstorm, which might threaten their safety or the safety of the public. Weather stations comprise sensors that measure wind speed and direction, atmospheric temperature, barometric pressure, humidity, precipitation, and other variables. Data from weather surveillance equipment can be input directly to a computer and coupled to atmospheric plume models.*

### Technology

Weather surveillance equipment includes fixed and portable weather stations that contain, at a minimum, an anemometer for determining wind speed and direction (i.e., wind velocity); sensors for atmospheric temperature, barometric pressure, and humidity; a system for determining inclination and orientation of the station; and a power supply. Some stations may also measure precipitation, cloud height, solar radiation, and turbulence. Because fixed weather stations (Figure 1a) need to operate reliably for long periods under adverse weather conditions, this equipment uses rugged sensors that usually have no moving parts and require little or no maintenance. Examples are ultrasonic anemometers (Figure 1b) for measuring wind velocity, and solid-state sensors for measuring temperature, barometric pressure, and humidity. Ultrasonic anemometers measure the time-of-flight of sonic pulses between three pairs of transducers on non-orthogonal axes, from which wind velocity, and also temperature, can be accurately computed. Fixed weather stations often

(a) (b)

**Figure 1. (a) Fixed Weather Station, and (b) Ultrasonic Anemometer.**
*Photos courtesy of R. M. Young Company*

utilize a sensor module, which comprise several sensors integrated in one unit.

Data transmission from a weather station to a display, remote computer, or a local area network can be hardwired or wireless. Software is available that can display or store weather data, calculate parameters, provide alarms, and interface with computer-based atmospheric plume dispersion models that predict the concentrations of a substance as it is transported and spreads in the atmosphere.

Portable weather stations are available in various types and configurations, and include tripod- or vehicle-mounted and handheld systems. Portable weather stations should be designed for ease of transportation, rapid deployment, and accuracy of measurement.

## Applications

Real-time weather information plays a critical role in CBRNE incidents in which hazardous materials are released into the environment. Firefighters, police, emergency management officials, and other responders use weather information to assess and analyze hazards and risks, make decisions concerning evacuating and sheltering-in-place, and protect themselves and the public.

After an accidental or intentional release of a hazardous material, information about prevailing weather conditions at the release site can be used to predict how the material might disperse in the atmosphere. For example, knowing only the prevailing wind velocity can help responders establish the relative risks in geographic areas surrounding the incident site. Atmospheric plume dispersion models can provide much more detailed projections. However, plume models need information about the nature, quantity, and release location of the hazardous material, as well as local meteorological information, especially wind velocity and temperature. Weather surveillance equipment can provide the local weather data needed to run a plume dispersion model.

Many weather stations can interface with the widely used ALOHA (Areal Locations of Hazardous Atmospheres) atmospheric plume dispersion model, and the CAMEO (Computer Aided Management for Emergency Operations) suite, a software system and database used to acquire information about potentially hazardous materials, and the locations where these materials may be used or stored. ALOHA is a subprogram of CAMEO.

Emergency responders should be aware of the limitations of using weather data and plume models; the limitations of the model need to be understood, and the weather data needs to be representative. For example, wind velocity measured in an urban area characterized by the presence of tall buildings can be highly sensitive to the location of the weather station. Many fixed weather stations are installed on the rooftops of tall buildings to mitigate building effects on wind measurements.

Another application of weather surveillance equipment is to establish landing areas for emergency response aircraft. Weather stations are installed at nearly every airport, large and small, to provide weather information for takeoffs and landings.

The National Weather Service (NWS) uses fixed weather stations, including Sodars (Sonic detection and ranging), wind profilers, Doppler radar, and weather satellite images to make specialized forecasts, such as the approach of severe weather that may impact first responder activities and emergency planning. NWS is an excellent source of weather information for first responders.

Knowledge about iced or flooded roads is important to the safety of first responders as well as the public. The Federal Highway Administration of the U.S. Department of Transportation has installed fixed weather stations along highways in 40 states. These stations report road and weather conditions in support of maintenance and emergency activities. Real-time road and weather data are available at http://ops.fhwa.dot.gov/weather/resources/links.htm.

## Resources

U.S. Department of Homeland Security, SAVER, *Portable Weather Stations Market Survey Report*, November 2010.

U.S. Department of Homeland Security, SAVER, *Atmospheric Plume Dispersion Models and Applications for Emergency Response and Recovery Handbook*, March 2013.