

Dr Christina Baxter, of EmergencyResponseTIPS.com and Hazard3.com, offers helpful advice for first responders

# Keeping you safe!

This column is intended to provide operational guidance to the hazmat/ CBRNE community regarding the selection and performance of equipment and tactics. For this segment, we will focus on the use of thermal imaging cameras (TICs) in hazmat/ CBRNE response.

TICs have a wide range of uses in hazmat response including detecting chemical reactions, tracking leaks/spills, taking incident photos, looking through vapours or smoke, 'seeing' invisible fires, and determining the level of a product in a container.



### Purchasing considerations

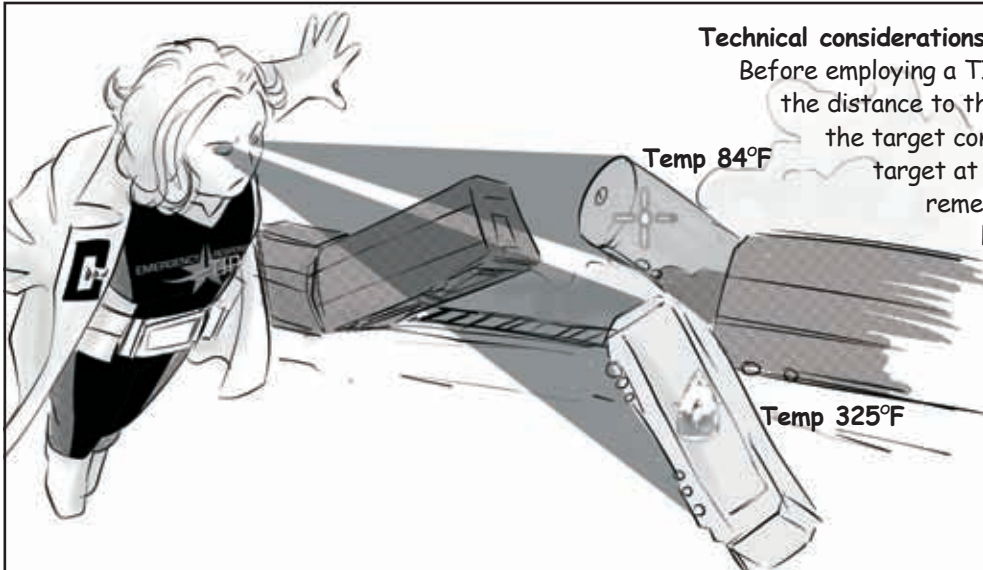
Before purchasing a TIC for hazmat/ CBRNE response, it is important to consider the instrument's effective temperature range, accuracy of measurements, resolution and refresh rates. While instruments with low resolution and low refresh rates are often used for situational awareness in firefighting, they are not as suitable for hazmat response. In those situations, tactical TICs with high resolution and refresh rates are more helpful.



It is also advisable to look for instruments with an effective temperature range from less than 0 °C to greater than 500 °C. While instruments that measure down to -80 °C would be an excellent choice, they generally come at an increased cost and size, and require more maintenance. Finally, it is important that the accuracy or thermal sensitivity of the camera is low enough to allow for early detection of chemical reactions.

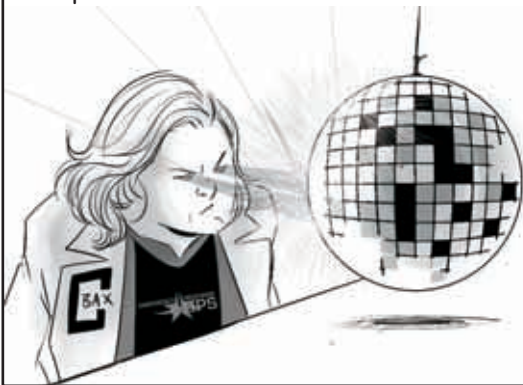
### Technical considerations

Before employing a TIC, the operator must consider the distance to the target and the emissivity of the target container. When measuring a target at a distance, it is important to remember that the instrument is looking at a larger field of view than the target alone, and will be averaging temperatures. On getting closer to the product, the field of view gets smaller and the temperature resolution will be much greater.



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The Merriam-Webster definition of emissivity is: the ratio of the energy radiated by a material's surface to that radiated from a perfect emitter, known as a blackbody, at the same temperature and wavelength and under the same viewing conditions. In an operational context, emissivity describes how reflective, or shiny, a surface is, whereas in a tactical context, a TIC will probably be unable to see the product level in a shiny container such as a tanker truck, and may also provide an inaccurate temperature for the container.



**Tactical utility**

**1. Detecting chemical reactions**

- Chemical reactions often result in a temperature change, with most being exothermic (involving the release of heat).

**2. Tracking leaks and spills**

- When a chemical escapes from a container, it may be visible using a TIC if the leaking chemical is at a different temperature to the environment or if the chemical is evaporating (evaporating vapours cool the area around the liquid). It is important to remember that toxic or flammable concentrations may still be present beyond the plume that is visible with the TIC.

**3. Determining product level in a container** - Solid and liquid products inside containers may be at different temperatures to that of the vapour space above them. Containers that are double walled, insulated, or jacketed will likely not be conducive to evaluation with a TIC. If the container is not insulated, but very shiny, and it can be approached safely. Consider applying masking tape or black vinyl electrical tape (or another high emissivity material) to allow for thermal measurements.



**4. Looking Through Smoke and Vapours** - In cases where part of the incident scene is obscured by smoke or vapour, a TIC may help see through the smoke or vapour to locate containers or personnel. In the event of a sudden change of visibility resulting from a power failure or a sudden product release, a TIC could be used to help the entry team navigate their way out of the hot zone or to assist the back up team with locating the entry team.

**5. 'Seeing' invisible fires**

- Some materials such as methanol may burn with an invisible flame, while others like hydrogen burn with a barely visible flame. In some cases, the flames are easy to see at night, but difficult to see in daylight.



**6. Taking incident photos**

- Many newer devices take both thermal and traditional photos simultaneously. These photos become an important part of the incident documentation.

**Stay safe out there!**



*Images are courtesy of Phil Buckenham  
<https://philbuckenhamart.wixsite.com/philbuckenham>*

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