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

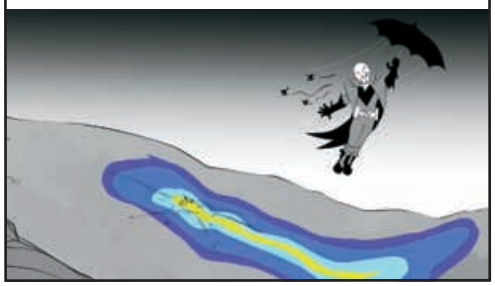
Keeping you safe!

The 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 setting control zones during a CBRN incident.

One of the first priorities during a CBRN incident is to establish hazard control zones throughout the site. These zones are administrative areas based on the hazards, situation and the risk to personnel and the community. As operational areas, these are meant to protect the response personnel, minimise exposure of unprotected personnel, and prevent the accidental spread of hazmat/CBRN agents. The zone designation is meant to be dynamic in nature and therefore must continually be re-evaluated throughout the response. Unfortunately, little guidance is provided on how to establish these zones.

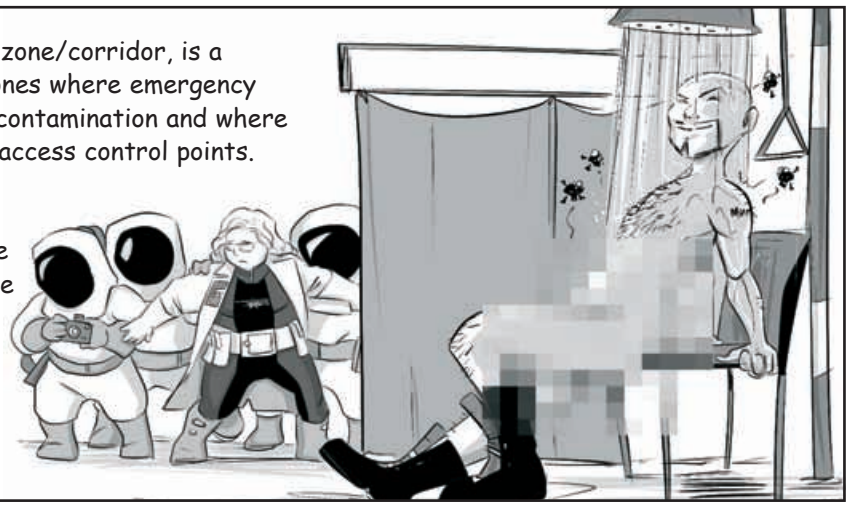
The hot or exclusion zone, is meant to define the area with the highest potential for exposure to or contact with hazardous substances. Entry and exit points for the hot zone are generally defined and marked. The marking may be as simple as setting out construction cones, using caution tape, or building parameters but should be obvious to everyone at the scene. All personnel entering this zone must have the appropriate training and don PPE as dictated by the incident commander, following the risk assessment for the incident. Monitoring equipment is generally incorporated to define the areas. Examples of the type of work conducted in the hot zone includes search and rescue, mitigation, sampling and monitoring.

The commonly used nomenclature for hazard control zones includes hot, warm, and cold zones, however, the terms inner and outer cordons are also used in many areas. In most cases, the hazard control zones shrink over the life of an incident response. It is important to undertake an ongoing dynamic risk assessment to ensure that the location, shape, and overall size of the control zones reflect the situation. The following factors should be considered throughout your assessment: chemical and physical properties of the product; state of the product; container; extent of release and atmospheric conditions; topography; life safety issues; environmental concerns; and available resources.



The warm zone, or contamination reduction zone/corridor, is a transition area between the hot and cold zones where emergency response personnel generally go through decontamination and where personnel and equipment enter and exit via access control points.

Personnel in the warm zone generally use a lower level of PPE than those in the hot zone as their potential for direct contact with the threat is far lower. Examples of the type of work conducted in the warm zone include decontamination and continuous monitoring for shifts in contamination levels, or to ensure that decontamination is complete.



Finally, the cold zone, or the support zone, is the area of the site where contamination or airborne concentrations are below the levels of concern or at acceptable levels. This is often where staging and planning occur. PPE is generally not required in this zone. Work performed in the cold zone typically includes medical triage, equipment staging and command functions. There are several approaches that can be used to define hazard control zones in a CBRN context, three of the more common approaches for chemicals are based upon toxicity, corrosiveness and flammability.

Toxicity approach

The most commonly used approach relies on toxicity end points to delineate zones with levels greater than immediately dangerous to life or health (IDLH) values, or equivalent for the hot zone/warm zone demarcation. Workplace exposure standards, such as permissible exposure limits (PELs) or occupational exposure limits (OELS) are used for warm/cold zone demarcation. This approach reflects a safety precautionary risk based approach as IDLH values represent high risk exposure concentrations, however workers should not knowingly enter areas at or above IDLH without appropriate protection. Likewise, the workplace exposure standards represent at least an eight hour work day and therefore a significant safety buffer. This is a likely approach for traditional chemical warfare agents like nerve agents, blister agents, blood agents and many toxic industrial chemicals.

Corrosives approach

When dealing with corrosive materials, it is important to determine first if the material is producing vapours. For corrosives that are vapour producing, the associated PELs or OELs should be applied using a toxicity driven approach. This is commonly used for acids with low vapour pressures like hydrochloric and nitric acids.
For corrosive materials that are not vapour forming, there is little threat outside the specific area of the spill. In this case, the hot zone is basically an administrative distance as there is little risk of exposure or continued spread, however it might be necessary to expand the zone, based upon chosen work practices or changes in container stability. An example of a work practice that can increase the zone size is when a carbonate based neutralisation solution is utilised resulting in the creation of carbon dioxide and hence material splattering. This approach is often used for common concentrations of sulphuric acid.

Flammability approach

In many cases the threat posed is a flammability hazard rather than a toxicity hazard. This is often evident from the absence of published occupational exposure limits. In these instances, it is important to set hazard zones according to an agreed percentage of the lower explosive/flammability limits (LEL/LFL). These percentages are generally agency specific but are often 10% of the LEL for the hot zone/warm zone line and 1% of the LEL for the warm/cold zone line. This approach is commonly used for events involving propane, methane and other highly flammable materials.

Remember, there are many different approaches that can be used to establish hazard control zones. The most important considerations are personnel and community safety, incident characteristics, and minimising the spread of contamination. Where possible use detection and monitoring techniques to continuously assess the incident and ensure that tactical measures are working.

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

Stay safe out there!