National Operational Guidance

NFCC National Fire Chiefs Council

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Contents

Hazard - Exposure to materials with acute health effects

Hazard Knowledge

Substances that cause health effects are commonly referred to as toxic, harmful or poisonous. These terms refer to a substance's ability to cause injury or damage to a human being, an animal or the environment.

Uncontrolled materials that can affect health pose a significant hazard to responders if appropriate controls are not implemented to prevent exposure. In addition to posing risks to health, many of these materials will also present other hazards for the worker or emergency responder. This section deals only with those that relate to the acute health effects of the materials.

Two subcategories differentiate the way in which harm is caused:

- Acute health effects
- Chronic health effects

Acute health effects occur immediately or soon after contact with the hazard. They have a threshold level below which no harm can be observed, although for highly toxic substances this level can be extremely low.

Once symptoms are observable, their severity increases with increased dose, ultimately leading to the death of the organism that was exposed. This is known as the lethal dose. For inhalation hazards, this dose will depend on two key factors; the concentration in air and the time someone is exposed to this concentration.

These are the symbols fire and rescue service personnel are likely to see in relation to acute health hazards and acute toxicity:

Chronic, or long-term, health effects occur as a result of repeated or prolonged exposure to a hazardous material, or where the health effect arises long after the exposure occurs, such as exposure to cancer-causing agents.

The likelihood of chronic health effects increases with prolonged or repeat exposure. However, the severity of the symptoms is the same – for example, a cancer-causing substance can only lead to the development of a cancer or cancer will not develop at all. The likelihood of cancer increases with exposure.

Fire and rescue service personnel are likely to see the following symbols in relation to chronic health hazards. The transport classification and labelling systems do not include classifications for chronic hazards. Therefore, materials that cause chronic effects can only be identified through the Classification, Labelling and Packaging (CLP) labelling. For further information on the categories of toxic materials see A foundation for hazardous materials.

Four routes of exposure can lead to symptoms developing:

- Ingestion
- Contact with skin or eyes (skin absorption)
- Inhalation
- Injection or through cuts

The route through which exposure occurs can also be a significant factor in the speed and type of symptoms displayed. For example, exposure through a cut may mean that some hazardous substances get absorbed into the blood stream more quickly, enabling symptoms to develop rapidly.

Further details can be found in National Operational Guidance: Hazardous materials Control measure - Signs and symptoms of exposure

Substances with acute toxicity need to reach a certain accumulated amount within the body before the onset of symptoms. This is referred to as the dose. Beyond this amount, further exposure will increase the total dose received, causing the severity of symptoms to increase.

The total dose received is a result of both the concentration that an individual is exposed to and the duration of exposure. For example, a short exposure to a high concentration of a substance will lead to the same symptoms as longer exposure to a lower concentration.

The exact symptoms for a given dose are specific to the substance's toxicity but also the susceptibility of the individual exposed. Certain populations are typically more vulnerable to the health effects of hazardous materials, for example, the young and elderly.

A number of data sources provide information for levels of exposure and the expected effects. For further information, see National Operational Guidance: Hazardous materials Control measure – Substance identification, Control measure – Specialist advice: Hazardous materials and A foundation for hazardous materials.

Where a substance is known to display toxic health hazards, this information can be obtained from data sources such as safety data sheets (SDS). However, a number of substances have low intrinsic toxicity but can react to liberate toxic substances, particularly gases. The most common examples are materials that liberate combustion products with toxic effects, such as carbon monoxide.

In such cases where reactions or fire are involved, scientific advice should be sought to assist in identifying the level of hazard posed by the reaction or combustion products formed.

Asbestos

Asbestos-containing materials (ACMs) that are in good condition and left undisturbed cannot cause ill health as fibres will not be released. Handling or touching ACMs that are in good condition will also generally not present a risk. However, when they are disturbed or damaged, fibres are released into the air. Inhaling asbestos fibres is a major hazard to human health. Inhaled fibres can become lodged in the lungs and the body's natural defences are not able to break them down. The principle diseases known to be caused by exposure to asbestos fibres are asbestosis, lung cancer, malignant mesothelioma and asbestos pleural disease.

Control measure - Substance identification: Toxic materials

Control measure knowledge

This control measure should be read in conjunction with National Operational Guidance – Hazardous materials: Substance identification.

Ensuring that personnel immediately recognise the presence or potential presence of substances with toxic health hazards will enable suitable control measures to be implemented to protect responders and the public particularly in the initial stages of an incident.

Materials with the primary hazard of 'toxic' (other than toxic gases) will be assigned to UN Hazard Class 6.1. It covers substances that possess a low lethal dose.

Labelling

Materials labelled for transport or use will be displayed with one of the following symbols:

The exclamation mark symbol is used for other hazards in addition to 'harmful' (e.g. irritant).

UN Transport Class 2.3 is for toxic gases only, such as ammonia, chlorine or hydrogen chloride.

As well as labelling on containers, other information sources will enable other toxic/harmful hazards to be identified, such as Chemdata, Wiser and the Emergency Response Guidebook.

Information gained from containers or data sources should be compared with other information from the scene (such as signs and symptoms from casualties) to triangulate the information and increase confidence.

Strategic actions

Fire and rescue services should:

- Have procedures and support arrangements with regard to recognising toxic substances and how to protect people from acute health effects

Tactical actions

Incident commanders should:

- Use signs, labels, markings and container types to identify the presence of toxic materials

- Identify the location, physical state (solid, liquid, gas), type, quantity and toxicity of the released material

- Use detection equipment to identify and monitor levels of the toxic materials involved

Control measure - Cordon controls: Toxic materials

Control measure knowledge

This control measure should be read in conjunction with Cordon controls: Hazardous materials.

Once it is clear that toxic/harmful substances are involved, key control measures to protect responders and the public should be considered. An appropriate cordon will initially reduce the risk of exposure or contamination from toxic/harmful substance.

Additionally, for substances that pose an inhalation hazard, protective actions such as evacuation or sheltering-in-place may be necessary to protect people at further distances down-wind of the initial release.

When dealing with vapours, the level of toxicity will have a direct impact on the size of any hazard zone. Although hazardous materials are classified based on their lethal dose or concentration, when deciding on appropriate protective actions other levels have been identified in various data sources, which can assist in making tactical decisions:

- Workplace exposure limits (WEL) – published by the Health and Safety Executive, these determine maximum exposure limits for workers, either based on an eight-hour period known as the 'long term exposure limit' or 15-minute exposure known as the 'short term exposure limit' (STEL)
- Acute emergency guideline levels (AEGLs) – describe the human health effects from once-in-a-lifetime, or rare, exposure to airborne chemicals. AEGLs are used by emergency responders when dealing with chemical spills or other catastrophic exposures and are set through the collaborative effort of public and private sectors worldwide. AEGL values represent threshold levels for the general public. This includes susceptible subpopulations, such as infants, children, the elderly, persons with asthma and those with other illnesses.
- Immediately dangerous to life and health hazard (IDLH) – established by the American National Institute for Occupational Safety and Health (NIOSH) as exposure to airborne

substances that are "likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from such an environment". IDLH are used by respirator manufactures and provide an upper limit for this type of respiratory protective equipment (RPE).

Where it is not possible to contain the spread of a toxic substance, or for areas where a toxic substance remains, protective actions will need to be implemented to prevent harm to people and the environment in that area.

For members of the public, actions will generally be either to evacuate the area or take shelter indoors. To determine where protective actions are necessary, either direct monitoring or a model of dispersal will need to be used. See National Operational Guidance: Hazardous materials.

Anyone who may have been exposed to toxic or harmful substances should be monitored after the incident, in line with specialist advice. Certain toxic materials can produce delayed effects up to 48 hours later and may be exacerbated by physical effort.

Further information and guidance on these hazards and limits is contained in National Operational Guidance: Hazardous materials - Hazards; ' Exposure of responders to hazardous materials' and 'Exposure of the general public to hazardous materials'.

Strategic actions

Fire and rescue services should:

- Have procedures and support arrangements with regard to recognising toxic substances and how to protect people from acute health effects
- Assess the foreseeable storage, use and transportation of toxic substances within their response area and provide their responders with suitable and sufficient personal protective equipment (PPE)
- Provide processes and systems to enable emergency responders to identify toxic substances

Tactical actions

Incident commanders should:

- Establish exclusion zones, inner and outer cordons based on level of risk from toxic material

- Extend the initial cordon downwind for airborne toxic materials

- Consider additional post-incident monitoring of responders who may have been exposed to toxic/harmful material as effects may be delayed

Control measure - Containment: Toxic materials

Control measure knowledge

Managing a release of a substance with toxic health hazards will be primarily determined by their physical form. The overall objective is to disrupt the spread and prevent access to areas where the concentration is high enough to cause harm. The physical form as well as quantity are key factors that determine where harmful concentrations will spread. The physical form will then dictate vulnerable routes of entry, for example, inhalation risk from gases and vapours. In circumstances where it is not possible to prevent spread, dispersal to low concentrations should be considered. This option must be weighed against the wider impact on public health and the environment.

Where there is a continuous release, a key priority will be to prevent further material from escaping, minimising the size of the release and therefore the size and duration of any hazard zone.

Solids

Key properties that will affect the way solids behave, and therefore their spread, include

- Size of particles
- Melting point
- Water reactivity and miscibility

Liquids

Key properties that affect the way liquids behave, and therefore spread, include:

- Vapour pressure (vapours may be given off in dangerous quantities)
- Water reactivity and miscibility
- Relative density
- Vapours

Key properties that affect the way vapours behave, and therefore spread, include:

- Vapour density
- Level of toxicity
- Solubility in water

To make a full assessment of substances and their properties, suitable equipment and advice may be required. For crews who operate in this area, key control measures are to prevent toxic substances from getting into the body, therefore appropriate personal protective equipment (PPE), respiratory protective equipment (RPE) and decontamination should be assessed.

See National Operational Guidance: Hazardous materials

Strategic actions

Fire and rescue services should:

- Consider their local risks and provide procedures and support arrangements for gas and vapour monitoring including equipment purchase, mobilising, use and maintenance
- Provide suitable containment equipment to prevent the spread of hazardous materials

Tactical actions

Incident commanders should:

- Attempt to contain the spill or release of any toxic substances as close to the source as possible
- Determine the potential spread of toxic substances
- Protect emergency responders' routes of entry based on the physical form of the toxic substance
- Consider options to contain or disperse the spread of toxic materials in consultation with HMA

- Consider options to contain or disperse the spread of toxic materials in consultation with a hazardous materials adviser (HMA)
- Consider reducing vaporisation or gassing-off by covering or reducing the surface area of spills
- Consider reducing vaporisation or gassing-off by absorbing spills with inert materials
- Consider reducing vaporisation or gassing-off by reducing the temperature of bulk containers
- Consider the potential reaction between the toxic material and containment material / water
- Consider the potential reaction between the toxic material and containment material/water, in some cases producing heat and/or flammable/toxic gas
- Prevent accidental mixing of different toxic materials as this can lead to reactions which may give off large amounts of heat and or gas
- Consider using water spray or curtains to contain and control toxic vapours and gases

Control measure - Safe method of work: Asbestos

Control measure knowledge

Asbestos can be found in any industrial or residential building built or refurbished before the year 2000. It was used in many of the common materials used in the building trade.

The presence of asbestos-containing material at an incident does not automatically mean that it will present a hazard. The following three step hazard identification process will assist the Incident Commander's initial risk assessment:

- Step 1 – are asbestos-containing materials present?

- Step 2 – can asbestos fibres be released or disturbed?
- Step 3 – do responders have to enter the hazard zone?

Once it has been established that asbestos is involved at an incident, fire and rescue services must comply with a method of work that has been agreed with the Health and Safety Executive (HSE). This is to enable fire and rescue services to comply with an exemption to work with asbestos without providing 14 days notice to the HSE. The work method is set out in A foundation for hazardous materials.

Strategic actions

Fire and rescue services should:

- Comply with the Control of Asbestos Regulations 2012/Control of Asbestos (Northern Ireland) Regulations 2012
- Provide arrangements for medical surveillance of personnel following incidents involving asbestos (by an appointed doctor), where appropriate
- Ensure operational policy reflects all aspects of the agreed method of work
- Provide procedures and support arrangements for identifying asbestos-containing materials

Tactical actions

Incident commanders should:

- Comply with the conditions detailed in the Exemption Certificate from CAR 12 Asbestos Licensing and Notification Requirements
- Ensure a suitable method of work has been agreed with the Health and Safety Executive (HSE) prior to attending incidents involving asbestos-containing materials (for example, the method statement proposed in CFOA circular 2014-03)
- Identify the presence of asbestos-containing materials and assess the level of risk (High or Lower Hazard)

- Avoid disturbing or releasing asbestos materials wherever possible
- Avoid committing responders into areas that may lead to contamination with asbestos if possible
- Follow the three-step asbestos hazard identification process
- If entering the hazard area follow HSE agreed method of working with asbestos-containing materials
- Identify the presence of asbestos containing materials and assess the level of risk (High or Low Hazard)