# The SPILL 2.0

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Listings below are interactive



**Welcome to the first issue of the updated NCEC public sector newsletter, The Spill 2.0, which is designed to share chemical incident knowledge to ensure the safety of responders.**

The Spill provides the latest information on chemical incident knowledge and effective emergency response from the National Chemical Emergency Centre (NCEC).

Funded by the Department for Transport and Chemical Industries Association, NCEC has delivered the Level 1 emergency response component of the UK Chemsafe scheme for over fifty years through a 365/24/7 dedicated telephone number provided only to the emergency services and other nominated organisations. We have an expert team of chemical emergency response specialists, who support emergency responders dealing with any chemical incident, regardless of scale, regardless of location. As well as providing advice, including hazards, decontamination, and reaction predictions, we will endeavour to contact the manufacturer if further assistance is necessary.

NCEC additionally delivers chemical advice through the European Intervention in Chemical Transport Emergencies (ICE) scheme, which provides a robust network of experts across Europe, who share information as required to facilitate response to incidents.

# ENSURING SAFETY THROUGH EXPERT SUPPORT: NCEC AND THE CHEMSAFE SCHEME

**In 1973, the National Chemical Emergency Centre (NCEC) was set up by the UK Government to provide 24/7 emergency response support to transport incidents involving hazardous chemicals.**

## THE ORIGINAL INCIDENT

On 8 December 1972, a serious incident occurred in a natural dip on the northbound carriageway of the M6, just north of the Skelmersdale link at Orrell. Taking place shortly before 21:00, a tanker carrying oleum (containing 80% sulfuric acid) travelling from St Helen's to Whitehaven slowed to a stop due to traffic build up. It was a foggy evening with poor visibility causing a container lorry travelling behind to swerve and collide with the back corner of the vehicle, immediately releasing thousands of gallons of acid.

A 48-year-old off-duty nurse from Birmingham had been travelling to Scotland with friends and family when she witnessed the collision. She left the safety of the car she was travelling in to try to assist. The driver of the tanker tried desperately to warn of the danger posed by the acid by banging on his cab windows and gesturing for people not to approach. Unfortunately, these actions were mistaken for cries for help, leading the nurse to closely approach the tanker. The release of the material was not visibly obvious due to the fog, and it is thought that any gaseous material would have blended with the fog and any liquid material would have looked like water.

It is not entirely clear whether the lady was overcome by acidic fumes and collapsed into a pool of the material, whether she slipped on the acid, or if she walked directly into the stream of acid spilling from the tanker, but she was found in a pool of acid and sustained such serious injuries that she sadly passed away.

There were other casualties of the incident who sustained burn injuries, including the daughter of the nurse involved and the tanker driver. Cars also came to a halt behind the accident, with their occupants leaving vehicles to investigate the situation. Members of the emergency services attempting to help saw their footwear disintegrating as they walked in the acid. 20 people suffered minor burns as a result, but some required ongoing treatment for several years. The oleum involved was for use in the detergent industry. The vehicle owners, Leather's Chemicals from St Helens, sent 10 tonnes of soda ash to neutralise the acid but the clean-up process took over 12 hours and the motorway was closed until 13:00 the following day.

This prompted a call from the local MP for a full Whitehall investigation into the cause of the incident and a thorough review of the risk posed by the transport of dangerous goods. Questions were asked about the resources the emergency services had available for dealing with incidents involving dangerous substances. As a result, the UK Government decided that something had to be done with regards to hazardous substances being transported by road and the emergency services not knowing what they were dealing with. New control measures were introduced to ensure that bulk loads of corrosive substances were properly carried in suitable vehicles, that the loads were properly marked and that measures were taken to alert other road users and the emergency services of the hazards involved.

## MINIMISING RISKS TO PEOPLE AND THE ENVIRONMENT

Whilst NCEC was privatised in 1996 and has been part of Ricardo for some time now, this core service is still provided under the Chemsafe scheme with funding support from the Chemical Industries Association (CIA) and the Department for Transport (DfT).

The scheme is designed to deliver a rapid and co-ordinated response following a chemical incident to minimise the risks to people, the environment, assets, and reputation. As the Level 1 response provider of expert scientific support within this, we now provide advice for any situation requiring chemical information, both emergency and non-emergency, regardless of scale or location.

We are seen as a trusted response partner by both the UK Government, emergency services, and other response organisations who repeatedly call on us for support during chemical incidents or training exercises. We are also trusted by many chemical companies to hold their product data and contact details in case their products are involved in an emergency where the emergency services require support.

As part of the scheme, we also liaise with other national centres across Europe to ensure a robust support network for products travelling internationally. We also directly represent many companies globally through our wider Ricardo commercial emergency response business so we can often offer additional support if required.

## TRENDS AND PATTERNS OF INCIDENTS

NCEC is therefore perfectly placed to spot trends in calls due to our national role. Patterns can be used to inform training, develop shared learning, and inform response policy. We have compared the frequency of incident types on an annual basis for the last four years.

For the most recent year (April 2023 – March 2024) the incident categories that were in the most received call types were:

- Suspicious activity in terms of illicit labs (drug and / or explosive manufacture), suspicious chemicals or items found by law enforcement agencies, suspicious purchase activity, hobby chemists etc.
- Suspected gas leaks / fires.
- Individual chemical exposure (ICE) incidents.
- Fuel / heating oil leaks / fires.
- Batteries.
- Cylinder incidents, including acetylene.
- Cleaning chemical spillages / reactions / fires.

However, we have noticed that some trends have remained constant across all four years – specifically the suspicious activity category and the ICE category.

Other annual trends ebb and flow in frequency and there are other categories that have appeared as top incident types over the previous three years but seem to have decreased in frequency lately, including water treatment chemicals (water supply and pool chemicals), fertiliser and pesticides, refrigerant gases, mercury, incidents at domestic properties not captured in another category and storage / licensing queries.

NCEC is proud to still be supporting the emergency services through Chemsafe over 50 years on from our creation. Whilst it is no substitute for individual company emergency response arrangements, it does provide a safety net for first responders, supporting them to protect society and prevent escalation of any incident by providing expert scientific advice whenever needed.

*NCEC would like to thank Wigan Council Archives for their contribution to the content of this article.*

# UNEXPECTED TRIGGERS OF CARBON MONOXIDE ALARMS

**Between 2017/18 – 2022/23, there has been a 44% increase across England in the number of Fire Service call outs involving carbon monoxide (CO).**

This will have been influenced by an amendment to the Smoke and Carbon Monoxide Alarm Regulations 2015 in October 2022. Since then, it is a legal requirement for private and social rental properties to have a CO alarm fitted in any room used as living accommodation which contains a fixed combustion appliance, excluding gas cookers.

The intention is to detect leaks from faulty boilers. A growing awareness of the dangers of CO among homeowners, ease of installation of alarms and cheapness of alarms is contributing to the increase in domestic CO alarms in use throughout the country.

Consequentially, there has been an increase in the number of alarm activations. In 2022/23, there were 2,647 reported incidents involving CO which Fire Services across England attended. However, 60% of incidents attended were reported to be a false alarm.

Despite most incidents (95%) relating to domestic properties, commercial and industrial property CO alarms are also subject to false activation. A domestic CO alarm should produce an audible warning when it detects a concentration of CO above 50ppm. Commercial and industrial alarms will have activation levels suitable for their environment.

## CROSS SENSITIVITY

There are a variety of different reasons why a CO alarm may activate without the presence of CO. One of these is cross sensitivity. Different models of CO alarm have different electrochemical principles behind how they detect CO. Some sensors can detect non-target substances such as hydrogen ($H_2$), hydrogen sulfide ($H_2S$), volatile organic compounds (VOCs) or water vapour.

Therefore, activation can occur in the absence of CO – an example of this is steam from a shower. Other chemicals known to cause cross sensitivity (depending on the exact CO alarm model) include acetylene, acetone, ethylene, formaldehyde, and acidic or flammable vapours. It is also possible to poison CO sensors with alcohols, which will disrupt any future readings.

Exact cross sensitivities will vary between sensors, so it is important to determine the type of CO alarm and consider its known cross-sensitivity readings. This can be achieved by consulting the alarm's technical information sheet or contacting the manufacturer.

## COMMON INCIDENTS INVOLVING CROSS SENSITIVITY

NCEC has been contacted in relation to unexpected activations of CO alarms. Often, they can be attributed to inconsiderate use of fuel-burning apparatus, such as using diesel generators in an inadequately ventilated area, which is sometimes not declared to the emergency services. After obvious sources of CO (gas boilers, for example) have been discounted from the investigation, we have noticed a trend in incidents involving the following:

### Setting concrete or screed

This is thought to have activated the CO alarm because of cross sensitivity to VOCs which can be formed from additives in concrete or heated plastic components in a screed preparation area. Metal particles found in some concrete can also react with water to produce $H_2$, which could give a false positive. Water vapour formed as part of the curing process can also trigger an alarm. However, the presence of CO cannot be entirely ruled out as calcium carbonate is a major constituent of concrete / screed and this can react with certain metals (such as aluminium and zinc) to produce CO.

### Overcharging batteries

Overcharged batteries can produce gases. Lithium-ion batteries can release VOCs and $H_2$, and lead acid batteries can release $H_2S$ and $H_2$. These gases can cause cross sensitivity issues with CO alarms, depending on the model.

### Self-heating meals

Certain self-heating meals use metals like magnesium, which react with water to produce a lot of heat. However, $H_2$ is also generated, to which CO alarms can be cross sensitive.

The difficulty with a potential cross-sensitivity activation of a CO alarm is that it is hard to conclusively eliminate the presence of CO because there are few alternate ways to verify the reading of a CO alarm.

The use of a photoionisation detector (PID) could help to rule out CO or $H_2$ and suggest the involvement of VOCs as CO and $H_2$ cannot be detected by a PID. If a PID identifies VOCs and there is no clear source of CO (or $H_2$), it may be a false alarm due to cross sensitivity.

However, asking for the type of CO sensor in use (model and manufacturer) will provide a greater understanding of the likely cross sensitivities and the associated risk posed by any obtained readings. In the above examples which NCEC consulted on, a PID was not available.

## MANAGING POTENTIAL FALSE ACTIVATIONS

Despite the potential for false activations, CO alarms provide a greater level of safety for residents.

CO is a highly flammable and toxic gas. CO detectors are primarily aimed at preventing impact to human health when there is a release of the gas, which is invisible and odourless. Improperly ventilated rooms, faulty appliances or inappropriate indoor use of BBQs have led to fatalities because a CO detector was not in use.

Initial symptoms of CO poisoning are difficult to identify as they are not specific (headache, fatigue, weakness, nausea, and vomiting) and can be mistaken for more common illnesses such as influenza. More serious CO poisoning symptoms from chronic exposure or a sudden large release of CO can lead to drowsiness, hallucinations, visual disturbances, seizures, and death.

Therefore, until a CO release can be definitively ruled out, the incident should be managed as a genuine activation and relevant precautions should be taken.

Persons should evacuate the area, which should then be ventilated thoroughly before being resealed. Monitoring should subsequently be conducted by people in appropriate personal protective equipment, including respiratory protection, to determine if the problem still exists and a build-up of CO reoccurs, with the alarm reactivating. Ideally, a conclusive identification of the activation source should be made before allowing re-entry to the property without personal protective equipment. If this is not possible, occupants should be advised to evacuate immediately if the alarm activates again.

**Statistics sourced from:**

GOV.UK. Carbon monoxide incidents, 2012 to 2023 (www.gov.uk/government/statistics/carbon-monoxide-incidents-2012-to-2023)

# INDIVIDUAL CHEMICAL EXPOSURE (ICE) INCIDENTS: SODIUM NITRATE / SODIUM NITRITE INGESTION

**There has been a noticeable increase over recent years in the use of sodium nitrate / sodium nitrite in individual chemical exposure (ICE) incidents.**

Sodium nitrate ($NaNO_3$) is a naturally occurring, colourless, crystalline solid, commonly used in fertilisers, laboratory synthesis and as a food preservative. It is rarely encountered in its pure form in a domestic setting and should only be found in trace amounts within certain store-bought foods. In this context, sodium nitrate has very little risk as it is classed only as an oxidising substance, and it has been approved for human consumption.

It is similar in appearance, composition and use to sodium nitrite ($NaNO_2$), a white - pale yellow crystalline salt of significant importance due to its wide industrial uses, e.g. as a precursor to pharmaceuticals, dyes, and pesticides, but it is perhaps best known as a preservative for meat. Again, it carries little risk when used as intended. However, sodium nitrite is classified as toxic, as well as being oxidising and hazardous to the environment.

## METHOD OF ACTION

Sodium nitrate is considered relatively non-toxic but inside the body approximately 5% of sodium nitrate is converted into sodium nitrite by bacteria in the saliva and gastrointestinal tract. The theoretical lethal dose is as low as 14 grams but much higher doses have been reported to have been ingested in fatal cases.

Sodium nitrite alters the iron in haemoglobin, which prevents red blood cells from carrying oxygen throughout the body, a condition known as methaemoglobinaemia. Symptoms may include headache, dizziness, shortness of breath, blue-coloured skin (cyanosis) and death. Therefore, pure sodium nitrite ingestion is more lethal, with fatalities occurring at ingestions as low as 0.7–6 grams. Effects are typically expected from 20 minutes to 8 hours after ingestion.

## HAZARDS OF THE SCENE

Sodium nitrate or sodium nitrite is often mixed with water to make the chemical easier to ingest. It will be difficult to determine the presence of sodium nitrate or sodium nitrite in water by testing and so circumstantial evidence at the scene should be considered. Often the material has been purchased legitimately either as a laboratory chemical or more likely from a food grade supplier so original packaging will be present.

However, there have been many documented cases of ingestion of the pure solid. Due to the oxidising risk, contact should be avoided with organic material to prevent accidental combustion. Decontamination can be carried out by removing the bulk of the material and rinsing any residues away with water and detergent.

Care should always be taken to assess the scene thoroughly to determine whether other ICE methods may have been used in conjunction with the ingestion of sodium nitrate / sodium nitrite.

## OFF-GASSING RISK

Ingestion of sodium nitrate may lead to the production of nitric oxide (NO) gas in the acidic environment of the stomach, with documented concentrations of over 100ppm present.

There are therefore concerns that the ingestion of a large quantity of sodium nitrate in an ICE incident will result in an off-gassing risk to first responders.

Furthermore, sodium nitrite can undergo transformation in the acidic conditions of the stomach to produce NO. Complex biological pathways indicate that NO could react further in the stomach to produce toxic and corrosive nitrogen oxides (NOx).

A casualty or deceased person may therefore be an off-gassing risk. It is thought that the method of ingestion may influence the potential risk, with solid ingestion more likely to result in off-gassing than if either substance has been made into a solution prior to ingestion. It may also depend on factors, such as quantity swallowed and the pH of the stomach contents. Whilst there have been no documented cases of any issues being encountered following this type of ingestion, the risk of off-gassing cannot categorically be ruled out so caution must be exercised as the situation is low risk but not no risk. However, even if off-gassing did occur, it would likely be a small amount, given the incident context.

## DETECTING $NO_x$ GASES

Frontline responders will not have the equipment to detect NOx gases. As a precaution, it is recommended to use breathing apparatus as typical respirator filters will not offer protection against NOx gases.

If the presence of NOx gases needs to be definitively ruled out, a detection identification and monitoring (DIM) team should be contacted. A photoionisation detector (PID) will be able to measure the concentrations of NO and $NO_2$.

## KEY ACTIONS

Even if the symptoms are mild, any surviving individual suspected of ingesting sodium nitrate or sodium nitrite must immediately receive medical attention due to the length of time it can take for symptoms to develop. Medical staff should carry out monitoring of respiratory and haemodynamic status, along with repeated blood gas analysis to detect whether the person is suffering from methaemoglobinaemia. The recommended treatment is methylene blue, but further information can be sought from the National Poisons Information Service (NPIS).

A judgement call may have to be made in terms of the handling of a deceased person. The scale of an incident may suggest that only a small amount of gas (if any) is likely to be produced but respiratory protection should be worn as a precaution. However, the filter on a CBRN body bag (like filtrating respirators) may not deal with the gases so this would need to be checked before their use was considered.

If responders wish to rule any risk out:

- Involve DIM if necessary to source a PID.
- Allow the body to off-gas in a safe and ventilated location until the PID readings are below 0.5ppm (8-hour workplace exposure limit and AEGL 1) when the body may be moved using a normal body bag.
- On removal of the body, ventilate the area until the PID readings are below 0.5ppm before allowing entry without personal protective equipment.

If the body needs to be moved without investigation, the filter can be closed to make the bag gas tight. However, this will be a very short-term option as the decomposition of the body and any other gases produced will cause the bag to swell. The produced gases will then need to be released in a controlled environment.

If the deceased is suspected to have ingested multiple chemicals, a CBRN bag must be used to protect against the hazard of any of the other hazardous gases that could be generated.

**References:**

Case Report: A non-fatal intoxication with a high-dose sodium nitrate - PMC (nih.gov)

Nitrate-Nitrite-Nitric Oxide Pathway | Anesthesiology | American Society of Anesthesiologists (asahq.org)

EH40/2005 Workplace exposure limits (hse.gov.uk)

# THE OPIOID EPIDEMIC AND THE EMERGENCE OF NITAZENES

**Nitazenes are the newest potent synthetic opioid family and are the latest chapter in the opioid epidemic story.**

Opium, extracted from the opium poppy, has been used recreationally or as a medicine for centuries. Opium derivatives, including morphine and heroin, have been used by medical professionals as effective analgesics since the 1800s, well before the extent of their addictive properties was realised.

Opioid abuse emerged as a social issue after doctors prescribed opioids for pain management without acknowledging their addictive nature. This was followed by unanticipated levels of addiction in the general population and misuse of the prescribed medications.

The US was most affected by this issue, which led to four distinct waves of opioid abuse:

WAVE 1 The late 1990s showed an increase in prescription opioid overdose deaths.

WAVE 2 In 2010, there was an increase in the number of heroin-related deaths due to reduced access to prescription opioid supply.

WAVE 3 2013 saw a rise in synthetic opioid overdoses attributed to the emergence of fentanyl.

WAVE 4 More recently there has been a trend of fentanyl being mixed with other drugs and contributing to more overdoses.

## NEW PSYCHOACTIVE SUBSTANCES

This is an umbrella term used to describe compounds that attempt to circumvent existing legislation but mimic the effects of traditional illicit drugs. Synthetic opioids, such as fentanyl and nitazenes, are considered a subcategory of new psychoactive substances (NPS).

NPS were outlawed under the Psychoactive Substances Act 2016 (and other drug control legislation applies to specified variations).

However, following the 2022 ban on poppy cultivation in Afghanistan, opium production decreased in this area by 95%, inevitably impacting the supply of export quality heroin into Europe. Consequentially, there has been an increased interest from organised crime groups in synthesising NPS to replace the gap in the market as they often require less space, time, and effort to produce than traditional drugs.

Although waves one and two of the opioid epidemic occurred primarily in the US, the introduction of synthetic opioids to the illicit drug market began a worrying global shift towards end users consuming these more potent NPS.

A common theme amongst NPS is that they are multiple times more potent than the illicit drug that they imitate. While NPS can be supplied in a pure form, it is more likely that end users are unaware that their dealer is selling them drugs cut with NPS.

### Fentanyl

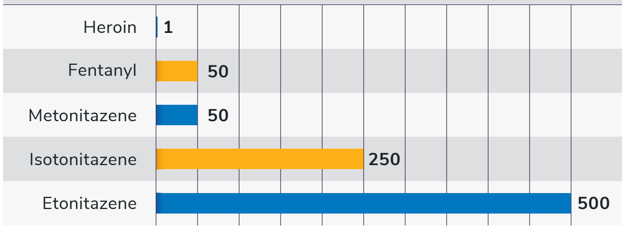
Fentanyl was discovered in 1959 and subsequently approved for medical use as an analgesic. It is frequently used in combination with sedatives to induce anaesthesia and it is on the World Health Organisation's List of Essential Medicines.

Due to its wide availability, recreational use of fentanyl and its derivatives first appeared in the 1970s. However, the significant increase in fentanyl overdose only began in 2013 when organised crime groups started cutting heroin and other traditional illicit drugs with fentanyl. Fentanyl is approximately fifty times more potent than heroin with two milligrams considered a fatal dose. The higher potency of the mixture is often not disclosed so end-users are susceptible to having their tolerance overwhelmed, leading to death.

## Nitazenes

Like fentanyl, nitazenes are a family of synthetic opioids developed in the late 1950s with an intended use as analgesics. However, they were not approved for use because of their potency. They all contain the same core structure but have subtle substitutions that vary the potency between specific nitazenes:

**Relative potency to heroin**




Metonitazene was the first nitazene identified as a contaminant in the UK illicit drug market in 2021. Data from 2022 suggests that there has been a rise in deaths related to drugs contaminated with nitazenes. Between June – December 2023, the National Crime Agency (NCA) had linked fifty-four deaths to nitazenes, with more overdose victims undergoing retrospective testing to determine if nitazenes were present in their bloodstream. As of May 2024, 176 deaths in the UK have been linked to nitazenes by the NCA. From a global perspective, there are therefore concerns that we may be at the beginning of wave five of the opioid epidemic.

Nitazenes are typically sourced online via social media from legitimate and illegitimate chemical manufacturers in China and imported into the UK disguised as food additives. Despite being regulated by the Psychoactive Substances Act 2016, importers claimed that nitazenes were legal since they were not explicitly classified under the Misuse of Drugs Act 1971. However, in March 2024, 15 new synthetic opioids of the nitazene family became classified as Class A drugs under this legislation, including metonitazene, isotonitazene and derivatives of etonitazene.

## TREATMENT OF OVERDOSES

Since nitazenes act on the same receptors in the body as traditional opiates (e.g. heroin), the same antidote, naloxone, is appropriate for a nitazene overdose.

However, overdoses of more potent synthetic opioids like nitazenes often require more than one dose of naloxone to reduce the effect of the drug. As some derivatives of nitazenes are up to five hundred times stronger than heroin, it is not clear if naloxone can be administered in high enough quantities or quickly enough to be effective for all variations.

This is further complicated by the lack of awareness of nitazenes within the UK. Patients experiencing an overdose are usually unable to communicate with medical professionals, who may see no improvement after administering naloxone and incorrectly assume that opioids are not involved in the individual's overdose symptoms. Even if the individuals can speak to medical professionals, they are often unaware that the illicit drugs they consumed contained nitazenes or do not want intervention as it also counteracts the desired effect of the drug taken.

## IDENTIFICATION

Nitazenes can be found as powders, counterfeit tablets, or liquids. Depending on the derivative, pure nitazenes will be a cream or pale brown colour and they will be injected by the user. However, they can be mixed with bulking agents and / or combined with other drugs such as heroin, fentanyl, and benzodiazepines.

Conventional fentanyl test strips cannot detect nitazenes. Nitazenes can be identified using Fourier-transform infrared (FT-IR) and Raman spectroscopy, but field drug testing equipment will have operational limitations and relies on the spectroscopic data for the nitazene in question to be in its library. Any suspicious samples would therefore need to be sent for further laboratory testing if conclusive identification is required.

## PRECAUTIONS

For nitazene overdoses, first responders should follow the same precautions as for suspected fentanyl overdoses, i.e. administering naloxone and treating symptomatically.

For suspected nitazene involvement in illicit drugs labs, an avoidance route approach is advisable for unknown powders. In general, a Tyvek coverall with goggles, gloves and a fit tested air purifying respirator would be suitable protection, but this should be based on a risk assessment at the time. However, if nitazenes are present in pill form, personal protection can be downgraded to nitrile gloves, a suitable sleeved garment, and a P2 dust mask.

**References:**

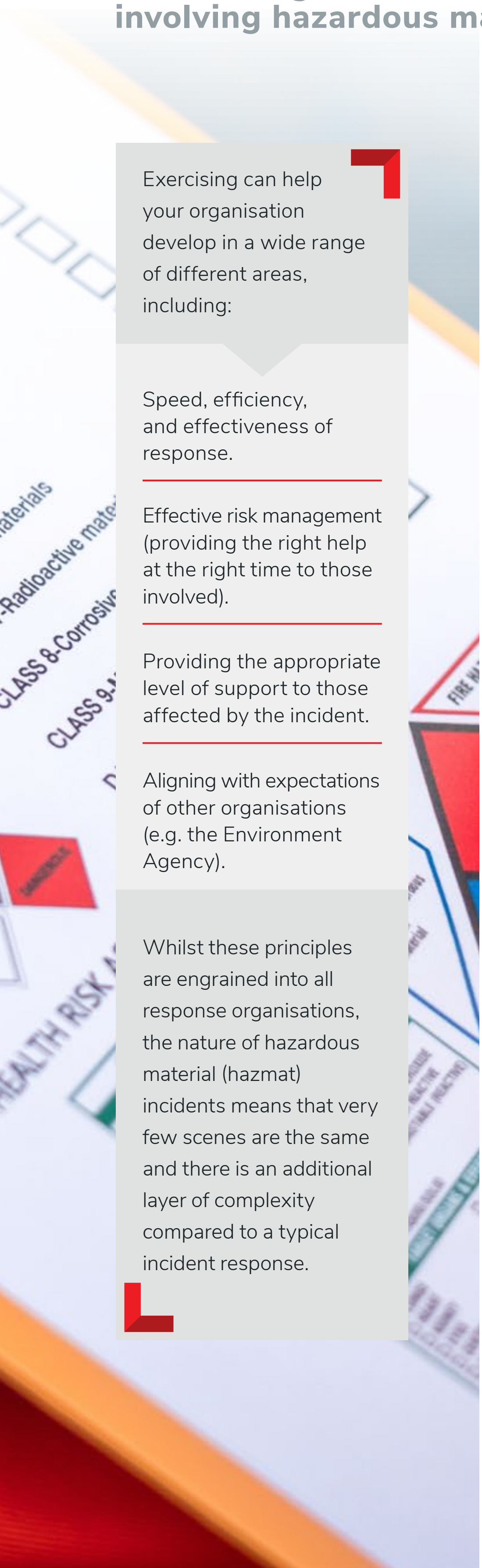
Old Drugs and New Challenges: A Narrative Review of Nitazenes - PMC (nih.gov)

WDR24_Key_findings_and_conclusions.pdf (unodc.org)

The fourth wave of the US opioid epidemic and its implications for the rural US: A federal perspective - ScienceDirect

# THE POWER OF EFFECTIVE EXERCISE PLANNING

**Well organised, realistic, and frequent exercises can be the key to determining the effectiveness of your response to a live incident involving hazardous materials.**



Exercising can help your organisation develop in a wide range of different areas, including:

Speed, efficiency, and effectiveness of response.

Effective risk management (providing the right help at the right time to those involved).

Providing the appropriate level of support to those affected by the incident.

Aligning with expectations of other organisations (e.g. the Environment Agency).

Whilst these principles are engrained into all response organisations, the nature of hazardous material (hazmat) incidents means that very few scenes are the same and there is an additional layer of complexity compared to a typical incident response.

## PLANNING THE EXERCISE

The first step to planning an effective exercise is determining what element of your response you are aiming to test. Is there a commonly encountered hazmat scenario that you are honing best practice techniques for, or are you establishing a response to an emerging hazmat risk? Is it a refresher on how to use certain equipment? Are you checking your response to a large-scale, multi-agency incident?

Secondly, consider the success criteria for the exercise and how you are going to measure the outcome against this. There are unique elements to a hazmat response that should be assessed, such as the potential for reactions, unstable scenes that can rapidly escalate out of control, or chemicals that have varying impact in different physical forms, i.e. solid, liquid and gas / vapour. Ideally, the criteria should reflect the participant's ability to identify the above considerations while prioritising the safety of people and the protection of the environment.

Of course, the criteria will vary depending on the scale of the incident, so the criteria will need to be amended as appropriate. For example, evaluating a response to a COMAH (Control of Major Accident Hazards) incident will require significantly more detail than dealing with a minor spill of a chemical.

Finally, how will you be running the exercise? Will it be a tabletop format or in the field, and will other organisations be involved?

## PREPARING THE EXERCISE

The most critical element to planning an exercise is creating a realistic scenario. Effective exercises have carefully considered where and when the scenario is taking place, as well as what chemicals are involved (quantities, concentrations, type of containment) and what the full context of the simulated scenario will be.

The persons acting in key roles such as the Hazardous Materials Advisor (HMA), Incident Commander, vehicle driver and any casualties will need to be briefed on information pertinent to their involvement in the situation and what is expected from them during the exercise.

For hazmat incidents, consider what questions will be posed, particularly to the HMA. What are the hazards of the substance? What are the major risks to consider? What personal protective equipment should be used to keep responders safe? What cordon size is appropriate? How do we remediate the incident?

The organiser should also prepare answers to questions that may in turn be asked by the HMA and consider what information may be needed to answer these questions. For example, if the scenario involves a spill at an industrial site, the HMA may ask what specialist equipment is available from the company involved to assist with the clean-up.

## DURING THE EXERCISE

All players participating in an exercise should carry out their assigned roles in line with the expectations stipulated in the brief given to them. To achieve this and ensure that the exercise remains realistic, organisers must closely supervise the situation as the scenario develops to ensure that the agreed-upon details are followed. Where the exercise may branch in different directions depending on the choices of the participants, organisers must be prepared to explore all possible outcomes and subsequently discuss the decisions taken that led to the chosen path in the debrief.

## AFTER THE EXERCISE

Following the exercise, the outcome should be reviewed against the standards expected. A good overall response to a hazmat incident should involve:

- Initially implementing appropriate defensive control measures to ensure the safety of people while the incident details are established.
- Effective data gathering for all chemicals involved and their associated behaviour, such as identifying potential for reactions.
- Application of chemical knowledge to ensure that advice is proportionate and tailored to the circumstances, for example amending cordon sizes based on the size of a hazmat spill or the surrounding environment.
- Tactical and regulatory awareness, such as notifying downstream users of a chemically polluted waterway.
- A considered course of action and a successfully delivered plan that does not over or under respond to the hazards of the chemicals versus the actual risks posed by the hazmat incident.

## COMMON ERRORS

Some of the commonly encountered issues we see with hazmat exercises include:

- Lack of consideration of the physical properties of a chemical, for example an incident based upon how to respond to a spill of pure methanol with a visible fire when in fact methanol burns with an invisible flame, or a scenario involving a liquid spillage when at ambient temperature the product is a solid.
- Choosing products unsuitable for the outcome of the exercise, such as needing to generate a toxic gas from a reaction but using incorrect combinations of chemicals that will not produce the required gas, e.g. using sulfamic acid and sodium hypochlorite solution to produce chlorine when this reaction will not occur.
- Unrealistic chemical involvement, such as using chlorine dioxide in a road traffic collision involving a correctly placarded vehicle when it is forbidden for transport.
- Too little contextual detail in the exercise scenario and subsequent lack of preparedness for questioning e.g. no description of quantities or concentrations and no consideration of the surrounding environment / weather conditions or any involvement of casualties.

## INVOLVEMENT OF CHEMSAFE IN EXERCISES

Chemsafe can facilitate a response to an exercise and a call will be handled in the same manner as if it were a real incident. However, we would ask that if you choose to make a call to Chemsafe that relates to an exercise, you ensure that you tell the Emergency Responder at the start of the call that it relates to an exercise to allow them to prioritise any emergency calls.

Incorporating Chemsafe into a hazmat exercise will increase your familiarity with our service so that you know what to expect when seeking support for a live incident. It is also a good idea to establish an idea of when your organisation wants to involve Chemsafe during the exercise and notify us of this in advance if possible.

Alternatively, Chemsafe can provide advice in advance of a planned exercise. For example, we can determine suitable chemicals to fit into your planned scenario, or we can design a scenario around some chemicals to meet the objective of your exercise. We would ask that all initial contact with Chemsafe is carried out by telephone and further communication can then be carried out by email, if preferred.

For more information on how Chemsafe can help with hazmat exercises, please contact **chemsafe@ricardo.com**

# SPONTANEOUS COMBUSTION OF ORGANIC OILS

**Organic oils are used widely throughout our communities but incorrect handling, along with contact with a combustible material, has led to spontaneous combustion causing significant damage to private homes and commercial properties.**

Organic oils have a broad range of applications, from furniture polishes to massage oils. Often, their purpose is simply to add a pleasant fragrance, but they can also be a functional component of the finished product.

Many common essential oils are classified as Class 3 Flammable Liquids due to their flash points of 50-60°C. Examples include tea tree, lavender, eucalyptus, and citrus oils. However, not all organic oils are classified as flammable as they have flash points above 61°C.

The issue of spontaneous combustion of organic oils arises from incorrect handling when they are imbued into a combustible material, for example a towel. Combustible materials soaked with organic oil are a known fire hazard, especially when stored in a restricted space, such as an airing cupboard, where any heat produced cannot dissipate.

## KEY RISK FACTORS

Three conditions that determine whether a reaction will cause dangerous heating are:

- Rate of heat generation.
- Air supply.
- Insulation properties of the immediate surroundings.

An ideal environment for spontaneous combustion to occur is during or after the laundering process, when heat can build up in a tumble dryer, for example, or when warm freshly clean items are stacked into piles, preventing heat from dissipating.

Often, laundering will not fully remove all the oils from the combustible material, resulting in residues unknowingly remaining behind. This can be exacerbated by using laundry powders incorrectly.

Biological ("bio") detergents contain enzymes that are effective at breaking down oils and fats, but only at low temperatures as if the wash is too hot, they are denatured. Non-bio detergents require hotter temperatures to dissolve similar stains. The temperature of a laundry cycle therefore plays a key role in determining how much residue of organic oils may remain. There is also an increasing trend towards saving energy by using colder washes, which can result in a build-up of oils over time. This can decrease the amount of heat required to meet the threshold for spontaneous combustion to occur if the materials are then stored in a warm place.

## MECHANISM OF ACTION

When an organic oil is wicked into a combustible material, the material provides a larger surface area for the oil to evaporate from and undergo oxidation. This process is exothermic and releases heat to the surroundings, further contributing to the oil's evaporation rate. This is an example of a positive feedback loop, a self-sustaining process that can readily cause a fire unless there is external intervention.

At a certain point, the accumulated heat generated by evaporation exceeds the rate at which the heat can dissipate into the surroundings, leading to a temperature increase that may eventually become hot enough to cause the material to spontaneously combust.

## TYPES OF PROPERTIES

Significant damage has been caused by fires in private homes and commercial properties, which have been started by organic oils spontaneously combusting.

The most common example would be laundromats, where poor maintenance of the washing machines or tumble dryers result in them not completing their cooling cycle or not being able to effectively distribute heat. However, restaurants may also be affected when they clean cloths soaked with cooking oil, craftworkers may have issues with rags covered in linseed oil, and massage parlours can accumulate towels or sheets contaminated with essential oils.

The fabrics may appear to have been cleaned, but when stacked in a pile in a warm place, such that the heat cannot escape, they can spontaneously combust. This could be an issue during summer months with fabrics placed in direct sunlight, or alternatively when fabrics are placed in an airing cupboard to dry during winter.

## RESOLUTION

According to the scale of a fire, any material that has spontaneously combusted should be doused with alcohol resistant foam, normal foam, or water.

Combustion products may be toxic or irritant, depending on the organic oils involved, but will primarily be carbon oxides, along with lower amounts of acrolein and other organic compounds. First responders should therefore only need to wear standard fire-fighting equipment, including breathing apparatus.

Unburnt, lightly contaminated fabric can be immediately washed at or above 40°C and hung out to thoroughly dry before re-use. If a drier is used, it should not be left unattended and it should be allowed to go through the complete cooling cycle, with the fabric then spread out to further cool as a precaution. However, for safe disposal of any heavily contaminated material, the material should be separated to dissipate the heat and hung to dry. Alternatively, the fabric can be soaked with water and placed in a plastic bag for disposal.

## EMOLLIENTS

Emollients are a type of cream used to treat skin conditions. They typically contain paraffin, an organic oil. Unlike essential oils, emollient creams are not classified as flammable liquids.

However, when they dry onto a combustible material, such as clothing, the residues act as an accelerant to increase the speed of ignition and intensity of a fire.

A 2018 government-led awareness campaign highlighted the danger of emollient creams impregnating clothing, bedding and other soft furnishings. Although the campaign encouraged frequent washing of bedding and clothing and focussed on the dangers of exposing items saturated with emollients to naked flames, there is also the chance that heavily contaminated materials could combust when exposed to a heat above 60°C.

Between 2010 and 2018, 50 fire incidents (49 fatal) were reported by the Fire and Rescue Services across England in which emollients were known to have been used by the victim or were present at the fire premises, although it cannot be definitively determined what role the emollient creams played in the outcome of the fire.

As of 2020, there were 11 cases in which paraffin-based emollients were suspected to have contributed to the speed and intensity of a fire, resulting in fatal burn injuries. There is the added complexity that the demographic of people who regularly use emollient creams are elderly, reducing their capacity to escape a rapidly developing fire.

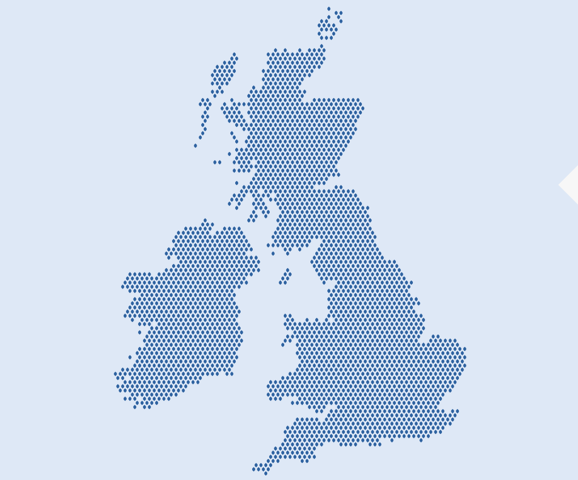
Sources:
Spontaneous Combustion - an overview | ScienceDirect Topics
https://www.firehouse.com/rescue/article/10528863/the-phenomenon-of-spontaneous-combustion
https://www.bbc.co.uk/news/uk-england-wiltshire-14436110

Statistics from:
Emollients: new information about risk of severe and fatal burns with paraffin-containing and paraffin-free emollients - GOV.UK

# LATEST CALL STATISTICS AND TRENDS

## CHEMSAFE INCIDENT TRENDS

**April 2024 - September 2024**



**Suspicious activity**
IDL's, finds by the authorities, suspicious purchase activity, hobby chemists etc.

**Batteries**

**Cleaning chemical spillages / reactions**

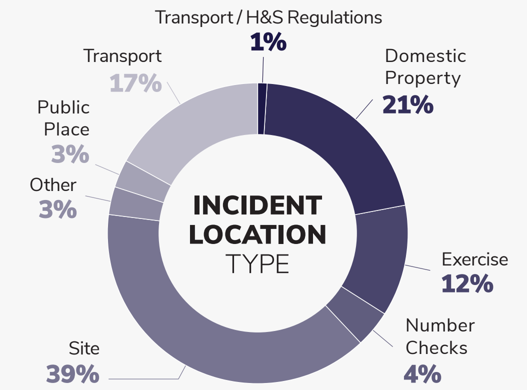
**Water treatment chemicals**
(water supply and pool chemicals)

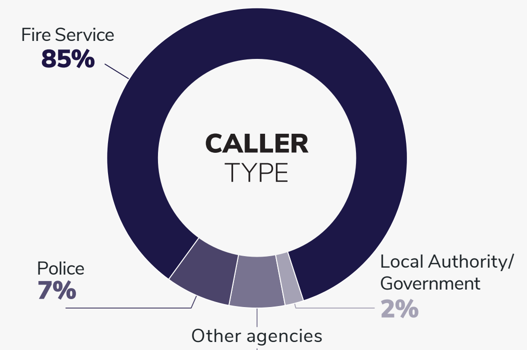
**Suspected gas leaks / fires**
including natural / town gas, carbon dioxide, refrigerants, LNG, LPG hydrogen sulfide

**Individual chemical exposure (ICE) incidents**

**Unknown substances**

## CHEMSAFE 2024/2025 year to date

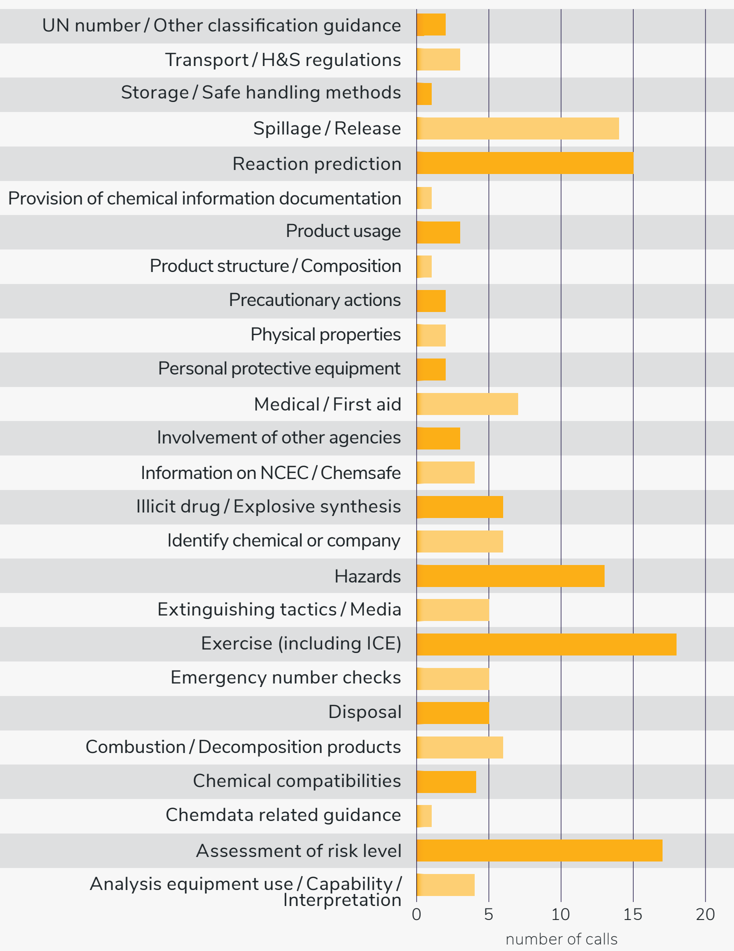



Other agencies calling Chemsafe (at less than 1% per agency)

| | | |
|---|---|---|
| Maritime and Coastguard Agency | National Crime Agency | Animal and Plant Health Agency |
| ICE Centre | Environment Agency | Medical Professional |

## MAIN ENQUIRY TYPE



# Chemsafe

## Emergency Services Refresher Training

FREE

NCEC provides refresher training for all eligible Chemsafe users.

The objectives of the training are to provide:

- A better understanding of the Chemsafe scheme and the role of NCEC within it.
- Technical training on individual chemical exposure (ICE) incidents.
- Technical training on waste fire incidents.

We discuss and review examples of the calls we have taken and run interactive scenarios based on real Chemsafe calls to enhance knowledge and promote shared learning.

The training is approximately 6 hours long if every element is required but it can be tailored according to which sessions you want to receive (the core Chemsafe session must be delivered).

It is completely free of charge and can be delivered in person or virtually.

**Contact details:**
01235 75 3363
chemsafe@ricardo.com
www.ricardo.com/chemical

Funded by UK Government

CIA Chemical Industries Association

NCEC RICARDO

# Countdown to Hazmat 2025: The UK's Premier Event for Hazmat Professionals

21–22 May 2025, Crowne Plaza Hotel, Stratford-upon-Avon

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SPECIALIST ADVICE 01235 753654 NCEC

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BOOK YOUR PLACE TODAY

Visit link here

Or scan the QR code

Registration deadline:
**14th May 2025**

Conference supporters

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# KEEP IN TOUCH

**If you have any comments about ‘The Spill’ or experiences of using the Chemsafe service that you would like to share, please contact us using the details below.**

You can also contact us if you would like to know more about Chemsafe, and the other services and products provided by NCEC.

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