Ambient Air Quality

Poor Outdoor Air Quality
(E.g. large fire)

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1. Air Quality Public Health Risk Assessment (PHRA)

Please note that this list is not exhaustive, but provides a series of suggested questions/prompts for information.

		CONSIDERATIONS	
	INCIDENT DESCRIPTORS	**Location**	• Name and address of site or premises; • Urban/rural setting – particularly interested in the density of population and residences around the incident; • Location of exclusion zone – empiric or based on real-time risk assessment; • Proximity to major services (i.e. hospitals, schools, residential facilities, factories, industrial sites, and Seveso sites); • Local Authorities (LA) linked to incident; and • Network and infrastructure in environs (i.e. ease in access to site or exit if evacuation is required).
		Nature of incident	• Was the incident accidental or deliberate; • What chemicals are involved (i.e. what's burning: e.g. tyres, waste, recycling material, industrial chemicals or asbestosis) and in what quantities? And are there any associated Public Health concerns; • How contained is the incident? • Are there any associated/related events? • Likely duration of incident? • How is the incident being managed?

		Air quality considerations	• Is there a plume? What is the current and predicted path of plume over immediate and associated environs; • Is there an odour? • Is a chemical meteorology service available? • Where are the nearest air quality monitors linked to the Environmental Protection Agency (EPA) Ambient Monitoring network with real0time data; • Any additional air quality monitoring on-going or planned in the area? (Using 24-hour average air quality measures to tailor health advice may not be adequate to deal with very high but short term peaks, which may cause serious health effects.
If there are gaps/omissions in this section, consideration should be given to holding an incident management team meeting	**CHEMICAL PROPERTIES**		• Chemical(s) properties and characteristics known and understood? (Include the UN/CAS number of substance(s) of concern) • Public Health concerns clear? • Quick dispersion likely?
	POPULATION		• Number of potentially exposed (including local population and first responders)? • Sensitive populations in the vicinity?
	IMMEDIATE HEALTH & IMPACT ON HEALTH SERVICES		• Exposure pathways? • Unusual symptoms reported to local/regional healthcare facilities, general practitioners (GPs) or National Poison Centre? • Number actually exposed (including local population and first responders)? • Sufficient capacity at local Accident and Emergency rooms?

	GENERAL PUBLIC HEALTH		• Initial PHRA and changes over time? • Individuals or populations at risk now/in future? • Public Health follow-up? Register needed? • Secondary contamination likely? • Treatment of contaminated/potentially contaminated people? • Specific antidotes or counter measures? • Delayed symptoms possible? • Close schools, businesses, other facilities? • Advice to shelter or evacuate? • Advice to wider community? • Advice to GPs and healthcare facilities? • Advice to media?
	ENVIRONMENTAL CONDITIONS		• Current and forecast weather conditions? (https://www.met.ie/); • Which direction is the wind? Is the smoke blowing away or towards sensitive properties or areas (i.e. housing, healthcare facilities, schools, factories etc.); • Any expected changes in wind direction? • Any rain? Will cause grounding of particulate matter; and • Check air quality index for health (AQIH) for information on health effects of altered ambient air quality? (https://www.epa.ie/air/quality/). • In the **Major Emergency Management preparedness planning**, might consider identification of EPA monitoring sites within its geographical area and near its boundaries. The nearest air monitoring site to each Top Tier Serveso Site could be included in the External Emergency plan. Air quality data from each permanent national network air monitoring site is available online from the EPA website. Frequency of testing and online updates varies by parameter and by site.

	INCIDENT CONSIDERATIONS	**Site issues**	• Environmental/biological sampling and monitoring needed? • Chemical reactions/new products likely? • Personal protective equipment in hot/warm zones? • Mobile decontamination at incident site or local/regional healthcare facility? • Any historical facts about the incident site (e.g. illegal dumping)?
		Response	• First responders (i.e. Fire Brigade; An Garda Siochana; HSE Ambulance; Civil Defence); • and • Is the incident site licensed wit LA/EPA? If so, are there records of materials/chemicals used.

		Actions - Immediate	• Introduce road blocks or cordon around the incident?
			• Advice local residents/users of premises of safe distance from incident;
			• **Major Emergency declared**? (Single agency activate own Emergency plan);
			• **Major Emergency not declared**?
			  ○ if there is significant Public Health risks, consider an escalated response (*procedures in the Green Books – A Framework for Major Emergency Management can still be activated in the absence of a major emergency*);
			  ○ consider requesting a local co-ordination team for the regular exchange of information and collected decision making (including and not exhaustive to LA, Fire Brigade; An Garda Siochana; HSE Ambulance; Civil Defence; HSE Public Health)

		Contact person(s) and communications	• Name, position, email and telephone number of person to contact/person-in-charge of co-ordinating the response.

		Actions - Overall	• Contact Public Health England – Centre for Radiation, Chemical and Environmental Hazards (PHE-CRCE) for advice (*contracted by the 8 Public Health Departments for 24/7 advisory response*); • Shelter Versus Evacuation; • If fire continuing: consider asking for a daily real-time visual plume assessment to inform the PHRA; • Shelter in Place (SIP) & Avoidance of smoke Public Health message (*consider need to cancel local events: football matches; concerts; other public gatherings etc.*); • Immediate local population may need different action/ advice than the surrounding general population; • Sensitive populations (e.g. those sensitive to the effects of air pollution) may need different action/ advice than the surrounding general population; • Note - Acute health effects are related to short term exposure (over a few hours to a few days). Chronic health effects are related to long term exposure (over months to years); and • Consider contacting local hospitals & GP practices (*database of those with symptoms*).

2. Air Quality Monitoring System

The Air Quality Index for Health (AQIH) is based on the level of pollutants as determined by measurements at a number of permanent monitoring stations. This is referred to as the ambient air quality and the index provides an indication of daily air quality in 6 regions across Ireland derived from data collected in an expanding network of monitoring stations.

It can be accessed via the EPA website: https://www.epa.ie/air/quality/ .

Health advice is provided for different short-term levels of air quality for those sensitive to the effects of air pollution and for the general population.

Using ambient air quality monitoring alone in a prolonged fire plume situation may not adequately deal with the potential health effects:

- The EPA ambient monitors may not be :
    - Appropriately sited to reflect local air quality during an incident
    - Producing timely, relevant or up to date air quality measurements.
- Air quality may be worse for residents closer to the fire than the general population exposed. Monitoring of the ambient air quality may not be a true reflection of the air quality for these residents.
- The public can tell when smoke is getting worse and want the authorities to provide advice on how to respond to these changes.
- Conversely smoke may clear enough to safely allow outdoor activities and advice based on a retrospective 24 hour average may not allow outdoor activity.

The EPA has a mobile air quality monitoring units that could be moved/mobilised to the site of an incident if required.

3. Sheltering and Evacuation

The Fire Service is responsible for decision to shelter or evacuate but may request advice from HSE Public Health. When decided upon, the process of evacuation is the responsibility of An Garda Síochána. It is the responsibility of the Local Authorities to provide accommodation/ rest centres for evacuated populations.

This information and other tools are fully accessible on the Framework for a Major Emergency Management website (Available URL: http://mem.ie/).

In most cases, the preferred protective action response will be to Shelter in Place until further information is gathered for the decision making process.

Evacuation may expose the population directly to the smoke plume. It is generally safer to advise people to stay in their homes to reduce the level of exposure to the public and to emergency responders.

Evacuation requires time and is difficult to carry out effectively especially late at night or in the early morning.

3.1.Shelter in Place (SIP):

- Take shelter inside immediately to avoid exposure to the smoke;
- Close all exterior, doors, windows and vents;
- Close blinds and seal any gaps under doors or around windows and wall vents with towels, blankets or plastic;
- Turn off air conditioning systems or reverse cycle heating systems;
- Shelter in an internal room with the least amount of doors and windows;
- Do not use household products that increase indoor chemical pollution (sprays, perfumes, oils, scents);
- Do not smoke or burn anything including candles and incense; and
- Do not vacuum because it stirs up particles.

3.2.Evacuation is preferable when:

- there is a potential risk from explosion or spread of fire;

OR

- the area is not yet exposed but will become exposed due to forecast wind direction;
    - with the likely exposure duration means protection by sheltering may be insufficient; and
    - There is sufficient time to carry out an evacuation.

3.3.Adverse effects associated with evacuation:

- Increased morbidity & mortality among nursing home residents;
- Infectious disease among those residing in shelters;
- Exacerbation of mental illness in adults; and
- Poor mental health among children.

The decision to authorise return after evacuation depends on adequate information to support the conclusion that the area is safe. After a major fire this may require some environmental monitoring data.

3.4.Return after evacuation:

- The incident is under control & not expected to escalate;
- Residential premises are considered safe;
- If necessary sampling and results completed;
- Advice has been provided about actions to take on returning home such as opening windows and doors; and
- Advice has been provided about whom to contact if health effects develop.

4. Sample Public Health Communications

4.1.Example 1

This was the initial health message written by Public Health on behalf of the HSE for the Kerdiffstown (Co. Kildare) landfill fire in 2011 (following advice from UK Health Protection Agency). The fire burned for a month. The public health message was sent out as part of a media release from the Local Authority (the Lead Agency).

Any smoke for people in good health the levels of air pollution we are seeing at present in the immediate vicinity of the Landfill are unlikely to have any serious short-term effects. However at times depending on the wind direction there may be some smoke in your vicinity. Any smoke is an irritant, so it can make your eyes and throat sore.

The general advice remains that people should stay out of smoke. Staying indoors with the door and windows closed will give a good level of protection. Some people may be sensitive to the effects of smoke. Those with existing respiratory or cardiac problems, young children and the elderly may experience symptoms.

The HSE advises that people with symptoms should reduce their level of activity, take medications as prescribed and consult their doctor.

4.2. Example 2

This was a tyre fire that persisted for over three weeks and generated a dark, dense smoke plume for over three weeks.

The incident in Wales was the first requiring activation a scientific and advisory cell (STAC), convened by the strategic co-ordination group at its first meeting to provide a single source of timely and coordinated specialist public health advice. Widespread public health advice to shelter was given and precautionary triggers were advised to inform decision making for closing public buildings and evacuation.

TRIGGERS DEVELOPED BY STAC FOR THIS INCIDENT:

- *Trigger to close public buildings: when outdoor concentrations of PM10 are predicted to be greater than an average of 160 µg/m^3 over a 24 hour period in an area then schools, nurseries, day-care centres and other similar facilities should be closed*
- *Trigger to evacuate: when outdoor concentrations in an area have been greater than an average of 320 µg/m^3 over a 24 hour period and it is predicted that concentrations of greater than an average of 320 µg/m^3 will continue for at least another 24 hours, then adverse health effects are likely to be significant and evacuation should be considered.*

4.3. Example 3

This was a large fire in the UK, at a waste processing and recycling centre in Burton Latimer, Northamptonshire, lasting for one month in 2011.

FIRST MESSAGE

Any smoke can be an irritant and as such, if people need to be outdoors, they are advised to avoid outside areas affected by any smoke or ash, or to limit the time that they spend in them.

Some of the substances present in smoke can irritate the lining of the air passages, the skin and the eyes. Respiratory symptoms include coughing and wheezing, breathlessness, sputum (phlegm) production and chest pain. If symptoms occur, people should seek medical advice or call NHS Direct on 0845 4647.

Chemicals in the smoke can worsen existing health problems like asthma. People with asthma should carry their inhalers.

SECOND (UPDATE) MESSAGE

The Health Protection Agency and NHS Northamptonshire continue to assess the potential impact of this fire on the health of local residents. Air quality testing at the height of the fire did not find significantly raised levels of pollutants and indicates that the risk to health is low.

Exposure to smoke can cause irritation and those most at risk are people with existing respiratory problems such as asthma and chronic bronchitis, or heart problems. People with pre-existing respiratory conditions may experience a short-term worsening of their condition if exposed to smoke and are therefore advised to keep their inhalers with them as a precaution.

If people are affected, short-term effects are likely to be those such as coughing, wheezing or a tight chest. These symptoms usually disappear soon after exposure has ceased and are unlikely to result in any long-term health problems

Our precautionary advice to residents in areas affected by smoke is that they should remain indoors and keep their doors and windows closed, where possible. People are advised to avoid outside areas affected by smoke, or to limit the time that they spend in them. People in areas unaffected by smoke need take no further action but may wish to open doors and windows once smoke has passed

We will continue to closely monitor the situation and will provide further updates and advice if the situation changes.

For general health advice or advice on managing symptoms, people should contact NHS Direct on 0845 4647 or via NHS website.

4.4.Example 4

This is a generic media statement provided in guidance produced by the Department of Health, Western Australia. It relates to the specific situation of a smoke haze resulting from a bushfire or other vegetative fire.

DEPARTMENT OF HEALTH URGES CARE IN SMOKE HAZE

The Department of Health has urged the public to take health precautions in response to bushfires burning in (insert region / area)

Department of Health warns that exposure to smoke from the bushfires could be particularly harmful to the elderly and the very young as well as people with respiratory or heart conditions.

Department of Health advises that a number of precautions should be taken to minimise the exposure of those at-risk to environmental smoke in order to prevent short-term health effects.

People are advised to:

- *Switch off those air conditioners that do not allow the fresh air intake to be turned off; and*
- *Shut doors and windows; and*
- *Only venture outside if necessary unless leaving the area. This is particularly important for those people with asthma and other respiratory conditions.*
- *Be alert to heat stress and keep cool and drink plenty of fluids except alcoholic drinks.*
- *People with asthma and pre-existing respiratory, cardiovascular illnesses or diabetes should be vigilant and follow their pre-prepared action/treatment plan.*
- *Look out for elderly neighbours or other people at risk.*

These steps should be followed until further notice and the Chief Health Officer urges people in the surrounding areas to the fire to take whatever steps necessary to isolate them from the smoke.

Exposure to smoke from fires can exacerbate asthma and other respiratory conditions, cause coughing and shortness of breath, and temporarily irritate the eyes, nose and throat.

People with respiratory or heart disease, the elderly and children should limit prolonged exertion and stay indoors when possible.

Peoples with known pre-existing conditions and the elderly should not participate in sport or physical exertion that increases cardiovascular activity.

In areas severely affected by smoke even healthy people should reduce the intensity of any required exercise.

Anyone experiencing worsening symptoms due to smoke should seek medical attention from their GP or from Health Direct on 1800 022 2222.

5. Use of Masks as a Personal Protective Measure (PPM)

Disclaimer: The Public Health Medicine Environment and Health Group (PHMEHG) are not experts in the area around use of PPM, but the information that follows is a synthesis of currently available evidence and should be reviewed with relevant experts to ascertain their applicability for certain settings.

Most masks will not provide adequate protection from the small particles and chemicals found in smoke. In order for a mask to provide adequate protection from the small particles that may be in smoke, it must filter very small particles (around 0.3 to 0.1 micrometre) and it must fit well, providing an airtight seal around the wearer's mouth and nose.

The particulate respirator is the simplest, least expensive, and least protective of the respirator types available. These respirators only protect against particles. ***They do not protect against chemicals, gases, or vapours, and are intended only for low hazard levels.***

The commonly known "N-95" filtering face piece respirator is one type of particulate respirator, often used in hospital to protect against infectious agents. Particulate respirators are "air-purifying respirators" because they clean particles out of the air as you breathe. However, even if you can't see the particles, there may be too many in the air for this respirator to provide adequate protection.

Masks manufacturer 3M have produced a leaflet on the use of masks for protection against smoke, ash and particulate air pollution.

Disposable respirators (N95 or P100) are increasingly available in hardware shops and pharmacies. Many people may wish to use them when going outdoors during smoke events.

There are several drawbacks to recommending widespread public use of masks in an area affected by smoke:

- *It is not easy to get a good seal. Most people won't use the masks correctly and won't understand the importance of having an airtight seal.*
- *It is impossible to get a good seal on individuals with beards or long side burns. As a result the mask will offer little if any protection.*
- *Some individuals may find a mask uncomfortable and may experience difficulty breathing from the increased resistance to airflow. This may lead to physiological stresses such as increased respiratory rates and heart rates.*
- *If used for a long period or if the breathing rate of the user increases to a sufficiently high enough level, breakthrough of potentially toxic gases may occur. Studies of respirator masks use by fire fighters found a reasonably high level of respiratory symptoms even when wearing the masks.*
- *The USEPA concluded that although masks may be useful for short-term protection, they may actually be detrimental by giving the wearers a false sense of security, which may encourage increased physical activity and time spent outdoors resulting in increased exposures.*

The *California Department of Public Health* recommend that for wild fire events, health officials should consider providing guidance on the proper selection and use of respirators, which can provide some level of protection despite the lack of formal fit testing and training.

The *Washington State Department of Health* has produced a leaflet on the use of respirator masks to protect against wildfire smoke. It is stated that respiratory masks shouldn't be used on small young children – they don't seal well enough to provide protection.

The Centers for Disease Control and Prevention (CDC) give seven tips for protecting your health during a wildfire smoke event. Tip 6 refers to the use of masks:

"Do not rely on dust masks for protection. Paper "comfort" or "dust" masks commonly found at hardware stores trap large particles, such as sawdust. These masks will not protect your lungs from smoke. An "N95" mask, properly worn, will offer some protection. If you decide to keep a mask on hand, see the Respirator Fact Sheet provided by CDC's National Institute for Occupational Safety and Health:

(Available URL: https://www.cdc.gov/niosh/docs/2003-144/).

The *Ministry of Health in Singapore* has provided guidance on the use and availability of masks during significant air pollution events**.** Some extracts from this guidance are presented below.

Do I need to wear a N95 mask?

- N95 masks are not needed for short exposure, like commuting from home to school or work, travel from bus-stop to shopping mall. N95 masks are also not needed in an indoor environment.

- A healthy person who has to be outdoors for several hours when the air quality is in the hazardous range AQIH Poor or Very Poor Air Quality may reduce exposure by wearing a N95 mask:

(Available URL: http://www.epa.ie/air/quality/index/).

- Surgical masks and N95 masks are different and were made for different purposes. Surgical masks were designed to protect the surrounding environment from the user's own spit or mucous. Healthcare professionals use them (e.g. in an operating theatre) to prevent their own germs from infecting the patient.

- N95 masks were designed to protect the wearer from airborne particles. Studies have shown that they are at least 95% efficient against fine particles that are about 0.1 – 0.3 microns, assuming good fit on the wearer's face.

- Normal surgical masks are not effective in filtering fine particles (i.e. tiny particles that are 2.5 microns or less in width), although they can reduce the discomfort cause by haze by providing a barrier between the wearer's nose and mouth, and larger irritant particles in the air.

6. Toxic Cloud and Public Safety Zones

The dose of exposure is the product of the concentration of the substance by the time exposed for complete pathways of exposure. The Acute Exposure Guideline Level (AEGL) incorporates safety factors to safeguard hypersensitive individuals and is designed to be very protective.

6.1. Cold, Warm and Hot Zones

The 10-minute AEGL-3, AEGL-2 and AEGL-1 will delimit the Hot, Warm and Cold Zones respectively. The 10-minute AEGL is the default on the Areal Locations of Hazardous Atmospheres (ALOHA) software used to model the plume that results from the toxic release.

Cold Zone

- Delimits the area of public concern
- Defined by AEGL-1: the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic non-sensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure
- Contains control and command post and other support functions
- Primary action: public information
- **Public Health advice**: information only as only minor transient effects. Timely information can help to allay public anxiety and limit psychological stress.

Warm Zone

- Delimits the area where population might be included in long term surveillance or be recruited into a cohort study
- Defined by AEGL-2: the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long lasting adverse health effects or an impaired ability to escape
- Fire and ambulance services permitted in the warm zone. Gardaí maintain cordons
- Access point into Hot Zone
- Decontamination area for the emergency services
- Primary action: casualty handling
- **Public Health advice:** information as for cold zone; in addition may need advice on first aid measures or decontamination activities, as health effects may be serious and non-reversible

Hot Zone

- Delimits the population that may require the assistance of the acute medical services
- Defined by AEGL-3: the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death
- Fire service only permitted in the hot zone
- Full protective equipment and clothing required as per Hazchem Code, Chemdata
- Primary action: casualty handling
- **Public Health advice:** advice as for warm zone; in addition the population in the hot zone may need the attention of the Emergency Services

6.2. Can exposed persons or casualties contaminate others?

By definition all those who have been exposed in the Hot or Warm Zone need decontamination. For example, if they were working outside when the emission passed over – they might be advised to remove all contaminated clothing and double bag it in plastic bags; to shower and put on fresh clothing; or to irrigate their eyes; as the situation may indicate.

6.3. Register of exposed

Public Health will be interested in a register of all those exposed in the Hot or Warm Zone – for epidemiological follow-up as appropriate.

7. Useful References

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    c. Available URL: https://www.gov.uk/government/publications/combustion-products-a-toxicological-review

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    c. Available URL: https://www3.epa.gov/airnow/wildfire_may2016.pdf

3. **A Framework for Major Emergency Management**
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    b. Published:
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4. **Evidence Review: Use of evacuation to protect public health during wildfire smoke events**
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    b. Published: March 2014
    c. Available URL: https://www.academia.edu/18835867/Evidence_Review_Use_of_evacuation_to_protect_public_health_during_wildfire_smoke_events

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6. **A study of particulate emissions during 23 major industrial fires: Implications for human health**
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    c. Available URL: https://www.cdc.gov/niosh/npptl/topics/respirators/factsheets/respfact.html

9. **Help protect yourself from airborne exposures to smoke, ash and particulate air pollution**
    a. 3M Technical Bulletin
    b. Published: 2017
    c. Available URL: https://multimedia.3m.com/mws/media/1454998O/help-protect-yourself-from-airborne-exposures-to-smoke-ash-and-particulate-air-pollution.pdf

10. **Wildfire Smoke and Face Masks**
    a. Washington State Department of Health
    b. Published: July 2017
    c. Available URL: https://www.doh.wa.gov/Portals/1/Documents/Pubs/334-353.pdf

11. **Protect yourself from Wildfire Smoke**
    a. Center for Disease Control and Prevention
    b. Published: July 2018
    c. Available URL: https://www.cdc.gov/features/wildfires/index.html