High Ambient Air Pollution on Overseas Defence Activity

Amendment record

This Annex has been reviewed by Directorate of Defence Safety (DDS) together with relevant subject matter experts and key safety stakeholders. Any suggestions for amendments to this chapter should in the first instance be directed to the Defence organisation's Safety Centre/Team Group Mailbox and with their approval, sent to DDS at: People-DDS-GroupMailbox@mod.gov.uk.

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1.0	10 Dec 25	First version of the High Ambient Air Pollution Annex to Chapter 43 (Force health protection aspects of medical planning) of JSP 375, Volume 1.	DDS

Introduction

1. This annex provides direction for protecting individuals, including dependants, for whom the MOD has a duty of care, against exposure to High Ambient Air Pollution (HAAP) during Defence activities overseas. This guidance is applicable to all working and living locations, activities, and situations, including all training environments overseas.

Background

2. Globally, air pollution as a cause of death is the second highest environmental risk[1]. Air pollution is contamination of the indoor or outdoor environment by any chemical, physical or biological agent that modifies the characteristics of the atmosphere. In this annex, HAAP is used to refer to the presence of harmful pollutants in outdoor air. These pollutants can come from various sources such as industry, households, motor vehicles, and natural events like forest fires. The most concerning pollutants include particulate matter, carbon monoxide, ozone, nitrogen dioxide, and sulphur dioxide[2].

Note: If personnel have concerns over indoor air quality (AQ) (for example vehicle emissions / fumes in a hangar / workshop and so on), then they should raise this with their local Environmental Health Team / Practitioner / Officer or DIO EH personnel.

3. Excluding air pollution incidents (for example an unplanned fire from an industrial site), air pollution in the UK does not routinely rise to levels where people need to make major changes to their habits to avoid exposure. However, this may not be the case with some overseas deployments or assignments.

[1] Total burden of disease from household and ambient air pollution
[2] Air pollution

4. There is a long-term dose-response relationship to exposure to these pollutants, which can result in serious health conditions such as respiratory, cardiovascular diseases and even cancer. Vulnerable individuals who are exposed to elevated HAAP are at greater risk from acute health effects, such as asthma exacerbations. This annex aims to minimise the risk of harm to all these groups to as low as reasonably practicable (ALARP).

Key Health and Safety Legislation

5. UK AQ legislation is a complex blend of international commitments, retained EU law, and domestic regulations. At the international level, the Gothenburg Protocol and its amendments establish emission ceiling levels for various pollutants, aiming to control long-range transboundary pollution. The main requirements of this protocol have been implemented in the UK through the National Emission Ceilings Regulations 2018.

6. Additionally, there is EU-level legislation concerning ambient AQ, specifically Directive 2008/50/EC (the 'Air Quality Directive'). Instead of setting ceilings for pollutants, this directive establishes 'limit values' (parameters that **must** not be exceeded) for concentrations of different pollutants. These limit values continue to be part of UK law.

7. Employers have a general duty under the Health and Safety at Work etc. Act (HSWA) 1974, Section 2 to ensure, so far as is reasonably practicable, the health, safety and welfare at work of all of their employees, and this would extend to protecting MOD personnel from HAAP when it is reasonable for the MOD to be aware of its presence.

8. While regulations 1, 5, 9 of the Control of Substances Hazardous to Health Regulations 2002 (COSHH) focus on protecting employees from workplace hazards, they also implicitly address non-workplace air pollution by requiring employers to manage hazardous substances.

Guidance

9. HAAP emissions can be natural or human-caused and are considered to influence human health. Personnel often become concerned when they can see or smell air pollution and this can make living and working in these conditions very unpleasant. However, some pollutants are neither seen nor smelt and can be more harmful. According to the World Health Organisation (WHO), 98% of cities in low and middle-income countries with >100,000 inhabitants do not meet WHO AQ guidelines[3].

Potential Health Effects

10. There is a dose-response relationship to ambient air pollution. The longer personnel are exposed to high levels of air pollution, the greater their risk of harm. People who are most vulnerable to HAAP are the elderly, children, and people with heart and respiratory conditions such as emphysema, bronchitis, chronic obstructive pulmonary disease (COPD) and asthma. The health effects from any Environmental and Industrial Hazards (EIH) may be assessed either as acute having an immediate (or mission) impact, or chronic (long-term) health impact.

[3] World Health Organisation – 'Sustainable Cities'

Acute Health Effects

11. HAAP can temporarily inflame the airway, decrease lung working capacity, cause shortness of breath, wheezing and coughing, and pain when inhaling deeply. It can cause eye and nose irritation including bleeding. It can dry out the protective membranes of the nose and throat and interfere with the body's ability to fight infection and increase susceptibility to illness. In addition, vulnerable individuals are at elevated risk from life-threatening health conditions.

Chronic Health Effects

12. The risk of chronic health impact is a calculation of whole life exposure and therefore cannot be extrapolated to a short period of less than 1 year in an area with HAAP. Noting increased post-tour respiratory morbidity has not been reported in personnel returning from operations known to have HAAP.

13. Although there is limited scientific evidence, short-term exposure of less than 1 year to HAAP is not thought to have any statistically identifiable long-term effects to non-vulnerable groups. For exposures to HAAP greater than 1 year continuous, or repeated accumulative exposure (for example multiple tours back-to-back), the risk of long-term health effects increases.

Natural Versus Human-Caused Pollutants

14. Some regions, particularly in the Middle East, most of the air pollution is naturally occurring sand and dust. However, there is no evidence that natural pollutants are any less harmful to human health. This is despite desert dust being subjectively more tolerable, as it has less odour than some human-caused pollution.

Mandatory HAAP Risk Assessment for Overseas Defence Activities

15. Risk assessments **must** be undertaken and periodically reviewed for HAAP, for all Defence activities overseas. Policy regarding health and safety risk assessments can be found in Chapter 8 (Safety risk assessment and safe systems of work) of JSP 375, Volume 1.

Note: Undertaking dynamic risk assessments **should** always be considered when carrying out any Defence activity, and activities in relation to HAAP are no exception.

16. The risk assessment for HAAP **must** include details of the preventive and protective control measures and what further action, if any, needs to be taken to reduce any risk to ALARP and tolerable.

17. Consideration for the risk assessment **should** include:

a. **Time:** Understanding the length of exposure to HAAP is important as an individual may be exposed for the full duration of a tour / assignment or intermittently. Seasonal variation may greatly impact AQ. For example, in a 6-month operational rotation, the summer tour may have far better AQ than a winter tour.

b. **Place:** In the same country / region, a rural location may have better AQ than an urban location where there is uncontrolled burning. The geography of an area is also important, for example, an inversion layer may trap pollutants exacerbating the problem.

c. **Activity:** A predominately office-based role may have less exposure than a Service Person patrolling a city with heavy traffic.

d. **Character of Air Pollution:** Some pollutants are more harmful and / or irritating than others. An understanding of the pollution constituents is crucial to the risk assessment. The most important pollutants are particulate matter (PM), nitrogen dioxide (NO2), ground-level ozone (O3), and carbon monoxide (CO).

e. **Person (Risk Group):** Some vulnerable persons are more susceptible to HAAP than the general population and require additional measures to be in place, which may include exclusion.

18. Sources of information for conducting a risk assessment for HAAP **should** include:

a. **Local Monitoring:** Feeds or measurements from an accredited host nation or commercial (including diplomatic) AQ monitoring stations.

b. **Organic Air Quality Monitoring Station:** For enduring or large-scale defence activity, where local (host nation) AQ monitoring is not available, then an in-house AQ monitoring system may be an appropriate solution. Before purchasing a system, specialist advice **should** be sought, as there are many off-the-shelf systems available, but not all meet the legal and scientific requirement.

c. **Deployment of Specialist Occupational Monitoring Team:** Specialist monitoring teams can undertake snapshot monitoring of AQ (for example during seasonal peaks), as well as develop more enduring monitoring plans and protocols.

d. **Environmental and Industrial Hazard (EIH) Assessment:** An EIH assessment **should** be undertaken of all new locations. In the first instance, this may be delivered by unit trained personnel, but higher EIH risk locations **should** be followed up by a visit from someone who is professionally qualified.

e. **Force Health Protection Instruction (FHPI):** Where the activity is subject to an FHPI, the drafter **should** take a whole hazard approach and use all available sources of information including AQ indices and previous visit reports to make a judgement on the likely AQ.

f. **Online Air Quality Indices (AQIs) / Forecasts:** AQI can provide an indication of air pollution either in real-time, as a forecast or as a historical record. There are many AQIs used globally. Each has a slightly different interpretation of the health impact of various pollutants. To provide a consistent approach for Defence activities when assessing risk, the DEFRA DAQI **should** be used and can be found in Appendix 1 of this Annex. Most online AQIs will also provide the raw data (for example PM2.5 measurements) which can be extrapolated to the DEFRA DAQI values.

g. **Observation of Pollution:** The presence of smog, smoke or industrial plumes that blocks the view of buildings or geographical features may provide a visual indication of HAAP. Likewise, strong chemical or burning odours, or particulate deposition, are also a good indicator of HAAP.

h. **Health Surveillance and Monitoring:** To augment the sources of information, health surveillance and monitoring may identify an increase in respiratory conditions due to HAAP indicating the requirement for mitigation measures.

Interpreting Findings

19. In this annex, HAAP is defined as the point where the risk owner **should** be applying controls and mitigation to reduce the risk from HAAP to their population at risk (PAR). Notwithstanding other factors such as pungent odour, for persons who are not vulnerable, a Daily Air Quality Index (DAQI) level of high and above would be the threshold of classifying an activity at risk from HAAP.

20. Due regard **should** be made to the most likely conditions for the duration of an activity or assignment. For example, a two-year assignment to Kathmandu will see long periods of HAAP, whilst a summer visit to Sarajevo is unlikely to encounter HAAP, despite protracted periods of particularly severe HAAP during the winter.

Identify and Medically Assess Vulnerable Persons Prior to Deployment

21. Certain individuals are at elevated risk from High Ambient Air Pollution (HAAP) and require additional safeguards. These include:

a. **Children under 5 years:** Due to their developing respiratory systems and inability to undergo objective asthma screening, children under 5 **must** not accompany parents to locations with DEFRA Daily Air Quality Index DAQI levels classified as High (7–9) or Very High (10).

b. **Pregnant personnel / dependants:** Individuals who believe they may be pregnant **must** not deploy to areas with elevated HAAP. Exposure during pregnancy can pose latent risks to foetal development.

c. **Personnel with respiratory or cardiac conditions:** Those with asthma, COPD, or heart disease **should** undergo occupational health screening prior to deployment. Deployment may be restricted based on medical risk assessment outcomes.

d. **Immunocompromised individuals:** Due to impaired immune responses, these individuals are more susceptible to pollutant-induced health effects and **should** be medically assessed before deployment.

e. **Adults over 65:** Age-related physiological changes may increase vulnerability to air pollution. Deployment decisions **should** consider individual health status and exposure duration.

f. **Dependants:** All dependants accompanying personnel **must** be risk assessed. Children under 18 require specific consideration, and those under 5 **must** not be assigned to high HAAP areas.

22. All vulnerable persons **must** be identified during pre-deployment screening and assessed in accordance with MOD occupational health policy and procedure. Where no operational imperative exists, exclusion from deployment to HAAP zones becomes mandatory.

Implement Controls to Reduce HAAP Exposure to ALARP

23. Controlling most sources of outdoor air pollution is well outside the scope of deployed Commanders who are not able to influence and demand action by local, national and regional level policymakers. Defence Engagement has been used in the past to work with the local population to reduce pollution in the locality of deployed bases. Air pollution issues **should** be elevated through the chain of command and the relevant Competent Medical Authority.

24. Commanders **should** be familiar with any environmental assessment (under JSP 816 requirements) that may identify sources of air contamination over which MOD has some control, for example the use of diesel generators, management of waste and so on. Commanders **should** make sure to follow the appropriate environmental protection policy to raise their risk assessments.

Pre-Deployment / Assignment Mitigations

25. As part of the estimate, or as a bespoke risk assessment, an area could be recognised as at risk from HAAP, as well as the control and mitigation requirement being identified. The following factors **should** be considered prior to personnel deploying to areas with HAAP:

a. **Screening of Personnel:** Personnel who have respiratory conditions are at greater risk from HAAP and require an occupational health assessment prior to deploying.

b. **Unit and Local Controls & Mitigations:** There are multiple controls and mitigations that units and deployed Commanders can apply to reduce the effects of exposure to HAAP:

(1) **Risk Assessment:** The threat of EIH **should** be considered as a planning factor when siting new locations and avoided where considered to be a risk to health (if operational necessity allows).

(2) **Living and Work Accommodation:** Living and working indoors **should** provide respite from HAAP. However, internal pollutants such as dust, cleaning materials, mould and the ingress of outdoor pollutants, may reduce the overall protection from being indoors. Internally generated pollutants **should** be reduced as far as possible (e.g. candles and aerosols) and ideally working and living accommodation **should** not directly open onto the outside. Doors and windows **should** be sealed against draughts and where possible a positive air pressure maintained to prevent the ingress of outdoor pollutants.

(3) **Avoid Hotspots:** Where possible, activity **should** be planned to avoid air pollution hotspots such as traffic intersections at peak times and being downwind of heavy industrial pollution.

(4) **Shift Patterns:** Ambient air pollution often follows a cycle where air pollution is worst at certain times of the day. Where the operational imperative allows, work patterns **should** be set so that personnel are not working outside when the ambient air pollution is at its daily peak.

(5) **Reduce Intrinsic Air Pollution:** Although not likely to impact the overall pollution for an urban area, some activity may temporarily increase local pollution experienced by deployed personnel. For example, vehicles idling to charge batteries, using burn pits. Intrinsic air pollution **should** be reduced wherever possible.

(6) **Inform Personnel of HAAP:** Personnel (including dependants) **must** be warned when AQ deteriorates. This could inform a tiered warning based on the DQAI health levels. How this information is communicated is at the discretion of the local commander and may include text messages or emails, visual signals (flags or signs), or when a geographical feature or building disappears in the smog.

(7) **Reception Staging Onward Integration (RSOI)Briefs:** All personnel deploying on PJHQ or single Service operations **should** have had a health brief delivered during RSOI by the Joint Health Briefing Team. This **should** include the threat and risk from ambient air pollution and local measures to control and mitigate this risk.

(8) **Workplace Health Record:** MOD Form 5051 or electronic equivalent **should** be completed where individuals are exposed to HAAP.

Individual Ambient Air Pollution Controls & Mitigations

26. There are a variety of controls and mitigations that individuals can undertake to reduce the potential effects of HAAP. These include:

a. **Reduce Activity Outside:** During episodes of HAAP, personnel **should** limit their exposure as far as reasonably practical by remaining indoors.

b. **Keep Windows and Doors Closed:** Make sure air is not recycled from outside from Heating, Ventilation, and Air Conditioning (HVAC) equipment.

c. **Set HVAC System to Recirculate Mode:** Where an HVAC system has a fresh air intake, set the system to recirculate mode, or close the outdoor intake damper.

d. **Close Outdoor Air Damper on Window Air Conditioners:** If you cannot close the damper, do not use the window air conditioner. Make sure that the seal between the air conditioner and the window is as tight as possible.

e. **Set HVAC System Fan to Continuous Operation:** If you have an HVAC system which has a filter, you can set the fan to continuous operation to pull indoor air through the filter, even when the HVAC system is not actively heating or cooling or when the heat / cool is intermittent.

f. **Avoid Using Portable Air Conditioners with a Single Hose:** If you have a portable air conditioner with two hoses, make sure that the seal between the window vent kit and the window is as tight as possible.

g. **Reduce Activities that Might Increase Pollutants:** Avoid smoking, wood smoke, cooking, lighting candles and so on.

h. **Do Not Vacuum Unless Using a HEPA-Filter Equipped Vacuum:** Keep the accommodation clean using a damp cloth or mop.

i. **Ventilation:** Ventilate the room once outside AQ is improved.

j. **Exercise Indoors:** An increased respiratory rate results in increased concentrations for inhaled airborne pollutants. If the air is cleaner indoors, then fewer pollutants will be inhaled than exercising outside.

k. **Localised Avoidance:** Levels of air pollution can significantly change over short distances, for example, by the roadside versus an open field. Certain areas on a base may therefore have higher levels of pollution which **should** be avoided.

l. **Quit Smoking:** Smoking, and to a lesser extent vaping, suppresses the muco-ciliary escalator in the respiratory tract and the ability to remove pollutants from the lungs. Therefore, personnel who smoke (and vape) are physiologically less suited to deal with HAAP.

m. **Vehicles Are Not Necessarily Safe Havens:** Pollution from exhausts can pass straight through vehicle air filters and accumulate in a vehicle cabin. Setting the vehicle air flow to recirculate in areas of high air pollution (tunnels or in very heavy traffic) will mitigate the risk of poor AQ.

n. **Contact Lens Wearers:** Contact lens wearers may be susceptible to eye infections where the pollutant irritates the eyes. The periodic wearing of glasses **should** be considered as an alternative to mitigate the risk.

o. **Personal Hygiene:** The absorption of air particles through the skin may be exacerbated in areas of HAAP. Showering and laundering of clothing may mitigate this risk.

p. **Respiratory Protective Equipment:** Wearing a mask is not included in DEFRA's recommended actions and health advice for dealing with air pollution, as evidence that Respiratory Protective Equipment (RPE) will provide real-world respiratory protection is not established. The effectiveness of masks depends on the pollutant, type of filter, and proper mask usage. A fit-tested FFP2 (USA equivalent is N95) may protect against particulates but not gas pollutants, so could be appropriate where personnel are exposed to sand or dust. Some people with respiratory conditions find that face masks make it harder to breathe.

q. **Medical:** Personnel are to be encouraged to report sick if they have wheezing, cough or other respiratory condition.

Post-Deployment

27. **Medical:** Personnel **should** be encouraged to report sick if they have wheezing, a cough, or other respiratory conditions after three weeks from returning from an area of HAAP. This will allow treatment and subsequent follow-up investigation, as necessary.

28. **Repeated Tours to Areas of HAAP:** Commanders and / or managers **should** make sure personnel are monitored for any long-term health effects due to repeated exposure to HAAP. This monitoring **should** include regular health check-ups and assessments to ensure that any potential health issues are identified and addressed promptly.

Record Individual HAAP Exposure in Health or Workplace Records

29. Personnel's personal health records **must** be updated following any HAAP exposure, while the use of MOD Form 5051[4] is not mandated, it is the recommended form through JSP 375.

30. Where personnel have been exposed to HAAP, broad details (as in no personal information) **should** be kept by the deploying commander in charge of the activity in order to better plan for following deployments.

[4] Please note that MOD Form 5051 is under review as part of a wider review into health surveillance policy and process.

Daily Air Quality Index (DAQI)

Table 1 below is an extract from DAQI - Defra, UK defining the level of air pollution for specified substances and to provide recommended actions and health advice (table 2) .The index is numbered 1-10 and divided into four bands, low (1) to very high (10), to provide detail about air pollution levels in a simple way, similar to the sun index or pollen index.

When using other sources such as World's Air Pollution: Real-time Air Quality Index the raw data **should** be extrapolated and used to determine the DAQI.

Index	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Band	Low	Low	Low	Moderate	Moderate	Moderate	High	High	High	Very High
$PM_{2.5}$ Particles μgm^{-3}	0-11	12-23	24-35	36-41	42-47	48-53	54-58	59-64	65-70	71 or more
PM_{10} Particles $\mu g/m^3$	0-16	17-33	34-50	51-58	59-66	67-75	76-83	84-91	92-100	101 or more
Sulphur Dioxide $\mu g/m^3$	0-88	89-177	178-266	267-354	355-443	444-532	533-710	711- 887	888-1064	1065 or more
Nitrogen Dioxide $\mu g/m^3$	0-67	68-134	135-200	201-267	268-334	335-400	401-467	468-534	535-600	601 or more
Ozone $\mu g/m^3$	0-33	34-66	67-100	101-120	121-140	141-160	161-187	188-213	214-240	241 or more

Table 1: Air pollution and banding by substance.

Recommended actions and health advice. Table 2 below is the DEFRA recommended actions and health advice for a given band or level.

Air Pollution Banding	Value	Accompanying health messages for at-risk (vulnerable) individuals[5]	Accompanying health messages for the general population
Low	1-3	**Enjoy** your usual outdoor activities.	**Enjoy** your usual outdoor activities.
Moderate	4-6	Adults and children with lung problems, and adults with heart problems, **who experience symptoms**, **should consider reducing** strenuous physical activity, particularly outdoors.	**Enjoy** your usual outdoor activities.
High	7-9	Adults and children with lung problems, and adults with heart problems, **should reduce** strenuous physical exertion, particularly outdoors, and / or if they experience symptoms. People with asthma may find they need to use their reliever inhaler more often. Older people **should** also **reduce** physical exertion.	Anyone experiencing discomfort such as sore eyes, cough or sore throat **should consider reducing** activity, particularly outdoors.
Very High	10	Adults and children with lung problems, adults with heart problems, and older people, **should avoid** strenuous physical activity. People with asthma may find they need to use their reliever inhaler more often.	**Reduce** physical exertion, particularly outdoors, especially if you experience symptoms such as cough or sore throat.

Table 2: Recommended action and health advice by air pollution band and value.

[5] Adults and children with heart or lung problems are at greater risk of symptoms. They **must** follow their doctor's usual advice about exercising and managing their condition. It is possible that very sensitive individuals may experience health effects even on Low air pollution days.