Guidance on Air Management in Asbestos Enclosures

GN006-V1120-Air management in asbestos enclosures

GUIDANCE ON AIR MANAGEMENT IN ASBESTOS ENCLOSURES

1. BACKGROUND

1.1 This guidance note is intended to clarify expectations with regard to air management, following recent industry research and the subsequent changes to the Approved Code of Practice. This note gives an overview of the general principles involved in air movement within enclosures as it is now understood. For more detail, please see the sources of further information listed in section 5.

1.2 Recent research provides a better understanding of air movement in enclosures and shows the limitations of the previous approach described in the Licensed Contractors' Guide (HSG247, published 2006). It is ARCA's understanding that the recent research will be reflected in HSE's approach to inspecting air management issues; enforcement action may be taken where licensed contractors cannot demonstrate that reasonable efforts have been made to manage airflow inside enclosures. Updated guidance will take the findings of latest research into account.

1.3 The term 'air changes per hour' is used in the guidance and ACoP. It is used to make a simple comparison between the volume of the enclosure and the volume of air being moved by NPUs. However, drawing 1,000m^3/hr of air through a 1,000m^3 space for an hour will **not** provide one complete air change, due to the effect of turbulence and persistent stratification within the enclosure. The previous approach to air management may result in enclosures without suitable negative pressure and with persistent 'stratification' caused by insufficient air mixing.

2. CONTROL OF ASBESTOS REGULATIONS 2012 AND APPROVED CODE OF PRACTICE (CAR & ACoP)

2.1. Regulation 16 requires employers to prevent the spread of asbestos fibres, so far as is reasonably practicable and to reduce spread to the lowest level reasonably practicable, where prevention is not possible. Enclosures under negative pressure are intended to prevent spread and paragraph 389 of the ACoP now specifies **a minimum airflow of 1,000m^3/hr through small enclosures (<120m^3), and at least 8 "air changes" per hour in larger enclosures**.

3. PRACTICAL GUIDANCE

3.1. The specified level of air movement (airflow of 1,000m^3/hr for small enclosures and at least 8 "air changes" for larger enclosures) has been shown to be the most reliable factor for good air management. Where this level of air movement is achieved, there is expected to be:

3.1.1 Negative pressure of c. -5pa (good containment)

3.1.2 Thorough air mixing in the enclosure (reducing exposure and spread)

3.1.3 There will also be an easy method for determining correct airflow, by using airlock door flaps as an indicator. 'Standard' flaps show a deflection of around 0.2mm for each 1m^3/hr of airflow (i.e. around 200mm at 1,000m^3/hr), **regardless of enclosure size**.

3.2 Terms & definitions - for the purposes of this guidance note:

3.2.1 'Standard' airlocks are the 'minimum' 1 x 1 x 2m stages. Where space allows, larger stages should always be provided to make decontamination easier.

3.2.2 Airlocks (flap weight and size) – The width and weight of the flaps are significant: wider, heavier flaps will offer more resistance to air. For the purposes of this note, 'standard flaps' are 0.8m wide and are "weighted" by rolling up excess 1,000-gauge polythene sheeting (approximately 380g).

3.2.3 Extra air inlets – all air movement is expected to be carefully planned and managed. Where extra air intake is needed, this should normally be achieved by providing additional 'air chambers'. For ease of management, licence holders should build air chambers to a uniform shape: a "single stage" airlock of 1 x 1 x 2m. They must be clearly marked with appropriate signage and fitted with barriers (netting, tape etc.) to prevent staff access.

KEY POINTS	
AIR IN = AIR OUT	Where enclosures are perfectly sealed, the volume of air pulled out must be equal to the volume of air allowed in. In other words, where an enclosure has a series of NPUs intended to move 10,000m^3/hr of air, it must be designed to allow 10,000m^3/hr in.
AIRLOCKS HAVE LIMITS	1,000m^3/hr of airflow through an airlock will deflect a 'standard' door flap around 200mm. At 1,500m^3/hr, the amount of deflection (c. 300mm) starts to restrict the space available for decontamination in the 'minimum' 1m square stage (at 4,000m^3/hr, the flaps would be hitting the next chamber of 'standard' airlock configuration). Where larger volumes of air are required, further air chambers should be planned and managed on site. **GUIDELINE LIMITS** *** 'standard' airlock or baglock = 1,500m^3/hr each** *** 'standard' additional air chamber = 4,000m^3/hr.**
NPUs & ACTUAL PERFORMANCE	Good air management planning requires knowledge of the ***actual airflow*** achieved by an NPU. Site teams should establish *actual* flow during set up, using an anemometer and mark the airlock to show flap deflection with this amount of airflow. During the works, the flap deflection can be used as a reference point to determine that the airflow has not changed. The site team should be trained to do this and the plan of work or standard operating procedures should inform and instruct the team as to what is required. For planning purposes, NPUs should be referred to by their last known *actual* rating rather than (nominal) manufacturer's rating. Standard units of measurements should be used throughout the organisation: i.e. m^3/hr. Variable speed controls may be of significant benefit, enabling larger units to be 'turned down' if necessary. These can be retrofitted for between £60 and £100. Some NPU's are fitted with speed controllers to vary the airflow produced by the NPU. Care should be exercised when using these, as unless you have a way of accurately determining the NPU's actual performance, such as measuring it with an anemometer, you can be unaware of the actual airflow it is delivering. Simply turning the speed control down to achieve 200-300mm deflection of the airlock flaps will not necessarily mean that you have good air management.
DUCTING & ELECTRICAL SUPPLY	The effect of ducting can be significant. As a "rule of thumb" ducting (either side of the NPU) is likely to reduce flow by 1% for each metre and by 2% for each bend. The quality of electrical supply (including length of cable runs) can have a significant impact on an NPU's actual site performance.
VARIABILITY	There are a number of variables in any enclosure system: for example, flap width and weight will have an impact on the amount of deflection seen. **Mark the side of the airlock to show the amount of flap deflection for the level of *actual* airflow through the enclosure, as designed.** Comparing amount of deflection against this mark during the project will be a good indicator of performance. Where variable speed NPUs are in use, the setting on the NPU should also be clearly marked and monitored.

3.3 Sample workplace scenarios

3.3.1 *'Large' enclosure dimensions approximately 20m x 20m x 3m =* *1,200m^3*

3.3.1.1 Minimum sized airlock & baglock configuration 12m^3

3.3.1.2 Total Volume 1,212m^3

3.3.1.3 Eight 'air changes': 8 x 1,212m^3 = **c.9,696m^3/hr minimum actual airflow required**

3.3.1.4 The contractor should provide NPUs capable of pulling 10,000m^3.The standard airlock/baglock configuration will allow a working maximum of 3,000m^3/hr of airflow; in order to achieve appropriate air movement, additional air inlets must be provided. The plan would need to include a baglock, airlock and **two** additional air chambers.

3.3.2 *Small enclosure (AIB removal in Housing Association property) for removing AIB in domestic cupboard*

3.3.2.1 Cupboard and airlock total volume of just 10m^3. ACoP specifies 1,000m^3/hr airflow to ensure adequate mixing. The NPU provided for the task must be able to draw this amount of air; flap deflection would be expected to be in the region of 200mm.

4. FAQs

4.1 In applying the minimum air extraction rate of 1,000m^3/hr for small enclosures (i.e. <120m^3), is there a point with very small enclosures that the airflow is too great, putting the enclosure integrity at risk?

4.1.1 HSE research carried out in 2012/13 (Health and Safety Laboratory report RR988 "Ventilation of enclosures for removal of asbestos containing materials") concluded that the standard enclosure construction of timber and polythene provides a sufficiently robust, strong and stable unit to withstand the new air extraction rate and significantly higher airflows. An air extraction rate of 1,000m^3/hr has no adverse effects on the stability and integrity of very small enclosures (e.g. 6m^3).

4.2 Is it true that LARC's are allowed to have both the airlock **and** baglock open at the same time?

4.2.1 Enclosures with an air extraction volume flow of about 1,500m^3/hr should result in an airlock flap deflection of approximately 300mm (for a 'standard' 1m x 1m x 2m airlock), thus maintaining sufficient changing space in the airlock. For larger air extraction volume flows, there becomes an increasing necessity for another air inlet. A baglock (where fitted) provides an ideal second air inlet, which will also result in a purging of the baglock. This principle is illustrated in figure 6.13 on page 101 of the Licensed Contractors Guide (HSG247) and is acceptable and recommended practice.

For much larger air extraction volume flows, e.g. above 4,000m^3/hr, further air inlets will be required, in addition to the baglock, to provide the additional make-up air.

4.3 Is it acceptable for my additional air inlet(s) to be a cut-out in the enclosure wall with a pre-filter fitted?

4.3.1 This is acceptable, but it is also acceptable to fit a single chamber airlock cube, with weighted flaps front and back, to the enclosure wall. For the latter, it is strongly advised that the outer opening is covered with mesh / chicken wire to make it clear that the chamber is not in place for enclosure entry or exit, for passing equipment in or out, or for waste removal.

4.4 If I have excessive airlock flap deflection, can I control this by making use of the variable flow control(s) on my NPU(s)?

4.4.1 Yes and no. If you can demonstrate that you have an excessive number of air changes per hour, you can reduce the airflow using the variable flow controls, **but** only down to the minimum 8 air changes per hour. To do this, you will need to be able to demonstrate how the airflow varies relative to adjustments of the variable flow control. Remember that the 6-monthly inspection and test report will only state the measured airflow at the maximum flow setting.
Therefore, airflow rates of the NPU's will need to be accurately measured at least at the start of each job, at various settings, if variable flow controls are to be used to regulate make-up air. As 'Air Out = Air In', if you reduce the flow of extracted air too much, then your incoming air will be insufficient to meet the legally required number of air changes. Similarly, if you overly restrict the amount of incoming air (e.g. by having insufficient air inlets), then the volume of your extracted air may be considerably less than the calculated amount, and again you may not be achieving the legal requirement in terms of air changes.

4.5 We have a number of perfectly serviceable old 500cfm NPU's (850m^3/hr). Can these still be used?

4.5.1 Used on their own they will almost certainly not meet the minimum 1,000m^3/hr requirement, but there is nothing to stop you using two or more, or using them in combination with other units, to meet the minimum air extraction rates required.

5. FURTHER NOTES

5.1 There may be other factors that will impact on pressure and air mixing within enclosures. For example, high/low ambient temperatures will effect pressure and (unavoidable) obstacles within the enclosure may be shown to have an impact on mixing. However, the general principles described above mark a definite advancement in our understanding of air management and should be reflected in planning and site control for all members.

5.2 If there are any voids within the enclosure which will be opened up as the work progresses, the planning will need to consider these, and consider how the airflow will be increased to take account of the increase in enclosure volume, and continue to maintain good air management.

5.3 The planned air management system for an asbestos removal enclosure should be sufficiently detailed in the plan of work to enable the supervisor to set it up as required, and to test it to ensure it is effective and performing as anticipated.

5.4 If air chambers are used to provide additional air intake, then some simple actions will be required to ensure sufficient airlock space is available: the actions include doubling the airlock door flap weight and opening the second baglock. By doing this it is possible to introduce an additional 4000m^3/hr of air into the enclosure via each air chamber and still restrict air entering the airlock and baglock to no more than 1500m^3/hr.

5.5 If air chambers are not practical due to site constraints, then filters can be cut into the enclosure wall to create air inlets.

5.6 The amount of air allowed in through a prefiltered air inlet is difficult to estimate. It is dependent upon the pressure difference between the inside of the enclosure and outside atmosphere, the size of the air inlet/filter and the filter medium. Almost every different size and make of filter will give differing values and therefore there is not a reliable method for calculating the amount of air a pre filter will allow into an enclosure. However, the amount of being supplied to the NPU's can be confirmed by checking the performance of the NPU using an anemometer, as air in equals are out.

5.7 Air inlets should have flaps fitted on the inside of the enclosure which close when the NPU's are switched off or the pressure drops.

6. SOURCES OF FURTHER INFORMATION

6.1 Health and Safety Laboratory report RR988 "Ventilation of enclosures for removal of asbestos containing materials"