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THE VOICE OF THE CLAY BRICK INDUSTRY

Environmentally Friendly

TECHNI-SHEET 1

Air Quality Monitoring

Clay Brick Clamp Kilns

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1. Introduction

Regulations issued in Section 21 of the National Environmental Management - Air Quality Act (39/2004) (AQA) stipulate that all clamp kiln operators must be in possession of an Atmospheric Emission License, and are to report on their emissions annually. The requirements for the monitoring of emissions are outlined below, as an extract from Government Notice 248 of 2010 in the Government Gazette 33064.

(2) Subcategory 5.2: Clamp Kilns for Brick Production

Description :	The production of bricks using clamp kilns		
Application :	All installations		
Substance or Mixture of Substances		**Plant Status**	
Common Name	**Chemical Symbol**		
Dust Fall	N/A	New	a
		Existing	a
Sulphur Dioxide	SO_2	New	b
		Existing	b
[a]:Three month running average not to exceed limit value for adjacent land use according to dust fallout standards promulgated in terms of section 32 of the NEM: AQA, 2004 (Act No. 39 of 2004), in eight principal wind directions.			
[b]:Twelve month running average not to exceed limit value as per GN 1210 of 24 December 2009. Passive diffusive measurement approved by the licensing authority carried out monthly.			

Two potential problems arise:

(i) Dust fallout standards in terms of Section 32 of AQA have not been finalised and published: Draft regulations issued in this section (Notice 1007 of 2012 in the Government Gazette 35931) proposed that the method of the American Society for Testing Materials (ASTM) "D1739 of 1970 or an equivalent" should be used. However, this method has long been superseded by the 2010 version (ASTM 1739-98, reapproved 2004 and 2010), which has also been published by SABS National Standards as SANS 1137:2012.

(ii) Most licensing authorities have little experience with Passive Diffusive Measurement.

Given the above, it is therefore proposed that the members of the Clay Brick Association adopt a uniform method for this measurement, and notify their local authorities accordingly.

The methodologies themselves are fairly simple to employ, but require access to laboratory equipment and experience. See Appendices A and B for more details. It is likely that the industrial hygiene practitioners already contracted into the relevant Clay Brickmaking concerns may be able to assist with the application of these methods.

In South Africa, Radiello passive tubes have become well known and are widely available. The catalogue number for the SO_2 tube is 166.

The dust fallout network should be set up as close to the boundary of the property as security allows in the eight principal wind directions, i.e. North, Northwest, West, Southwest, South, Southeast, East and Northeast. The passive diffusive tube mounting plates can be tied to the bucket stands using cable ties.

Appendix A: Dust Fallout Monitoring

The buckets, stands and procedure should follow the American Society for Testing and Materials Standard method for the collection and analysis of dustfall (ASTM D1739-98, reapproved 2004 and 2010, and also reflected in SANS 1137-2012).

The ASTM method covers a procedure for the collection and measuring of dustfall, by means of employing a simple device comprising of a cylindrical container (at least 150mm in diameter, and twice as deep as the diameter) that is exposed for at least 28-33 days. Hence, it is not necessary to adhere exactly to a calendar month, or to work over weekends.

The bucket stand should comprise of a windshield at the level of the rim of the bucket to provide an aerodynamic barrier.

The bucket holder is attached to a steel pole, so that the bucket rim is 2m above ground level. The pole can be attached directly attached to a fence post that can be concreted in, or stabilised using three tent pegs and rope or wire. The illustration below shows the latter.

To monitor dust fallout as per the ASTM Standard, mentioned above, the following is required:

8 bucket stands per site
2 buckets per stand (one in the field, the other being processed)
Distilled water
Plastic foil or wrap (cling wrap)
Data sheet
1 litre plastic containers with lids (10 will be required for each month of

At the end of the sampling period (28-33 days), the buckets of the stands should be exchanged with the second set. The following process is to be followed when exchanging dust buckets:

- The second set of 8 dust buckets must be washed and cleaned (inside and outside) with distilled water in a clean area or laboratory, in preparation for the dust bucket exchange process.
- The identity of each dust bucket should be clearly labelled according to the identity of the bucket stand, and the month in which the monitoring took place.
- The openings of the dust buckets should then be covered with a lid or plastic wrap to avoid any contamination and water spillages during transportation. A crate or box will assist in keeping the buckets upright while in-transit.
- In the field, each previously exposed dust bucket should first be taken out of the bucket stand and the opening covered with a lid or plastic wrap.
- The unexposed, clearly labelled dust bucket from the laboratory should then be placed on the labelled dust bucket stand, after the plastic wrap or lid covering has been removed.
- The time and start date of the monitoring process should be noted in the data sheet.
- The first set of dust buckets taken from the field should be placed in a crate or box, and then transported back to the laboratory. The inside areas of the dust buckets should then be rinsed thoroughly with water to ensure all trapped dust is washed to the bottom and the liquid poured into clearly labelled plastic bottles to be sent to the laboratory.
- The bottle labels should indicate the dust bucket identification and month of dust sampling. Alternatively, if the buckets can be transported directly to the laboratory in an upright position, they could be processed in the laboratory, as below.

At the laboratory each bottle will be rinsed with deionised water to remove residue from the sides, with the contents filtered through a coarse (>1 mm) filter to remove insects and other course organic detritus.

The sample is then filtered through a pre-weighed paper filter to remove the insoluble fraction or dust fallout. This residue and the filter are then dried, and gravimetrically analysed to determine the insoluble fraction (dust fallout).

Should the soluble fraction of fallout also be required (this will happen only in special cases), the liquid from the filtration will be evaporated in a drying oven at 100ºC and the residue weighed.

Appendix B: Passive Sampling for Gaseous Air Pollutants

1. Overview (Sigma-Aldrich, SKC)

Passive or diffusive sampling relies on the unassisted molecular diffusion of gaseous agents (analytes) through a diffusive surface onto an adsorbent. Unlike active (pumped) sampling, passive samplers require no electricity (expensive pumps), have no moving parts, and are simple to use (no pump operation or calibration). After sampling, the adsorbed analytes are desorbed off the adsorbent by solvent or thermal desorption.

Benefits of passive/diffusive sampling:

- Compact, portable, unobtrusive and inexpensive
- Indicates average pollution levels over time periods of 8 hours to weeks/months
- Requires no supervision, is noiseless and can be used in hazardous environments
- Low cost allows for sampling at multiple locations (e.g. for highlighting pollution "hotspots" or determining long term data trends in specific geographical areas)
- Amenable to personal monitoring (breathing zone), indoor air analysis and outdoor ambient air analysis.

It must however be recognised that passive samplers are essentially averaging devices that have a low detection limit. At low ambient concentrations, fairly long sampling times (days to weeks) may be required to obtain meaningful results.

Instructions for the use of Radiello Radial Passive Samplers

1. The Components

The essential parts of Radiello are the adsorbing cartridge, the diffusive body, the supporting plate and the adhesive label with the bar code indication. Apart from the adsorbing cartridge, and unless otherwise stated all of the other components can be repeatedly used for several sampling experiments.

1.1 The Adsorbing Cartridge

The adsorbing cartridges have dimensions of 60mm length and 4.8 or 5.8mm diameter. They are contained in glass or plastic tubes wrapped up in a transparent polyethylene thermo-welded bag - see adjacent figure. The code number, printed on the bag along with the lot number and expiry date indicates

the type of cartridge.

1.2 The Diffusive Body

The diffusive body dimensions are: 60mm (height) and 16mm (diameter), and has to be screwed onto the Supporting Plate, as showed below.

Instructions for the use of Radiello Radial Passive Samplers, cont'd

1.3 The Supporting Plate

The supporting plate is made of polycarbonate. It acts as both a closure and support for the diffusive body, which has to be screwed onto the thread. It comes with a clip and transparent adhesive pocket to hold the label, which does not need to be pole mounted. All three parts are required to be assembled before use.

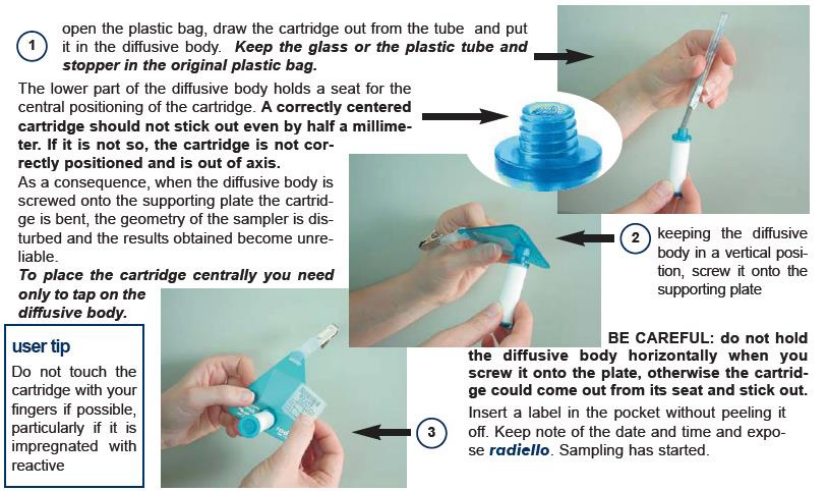
1.4 The Label

The label is self-adhesive with a printed barcode number. Since each barcode number is applicable to one copy only, it allows for the unmistakable identification of the sampling tube on both the field and in the laboratory for subsequent analysis.

2. The Sampling Methodology

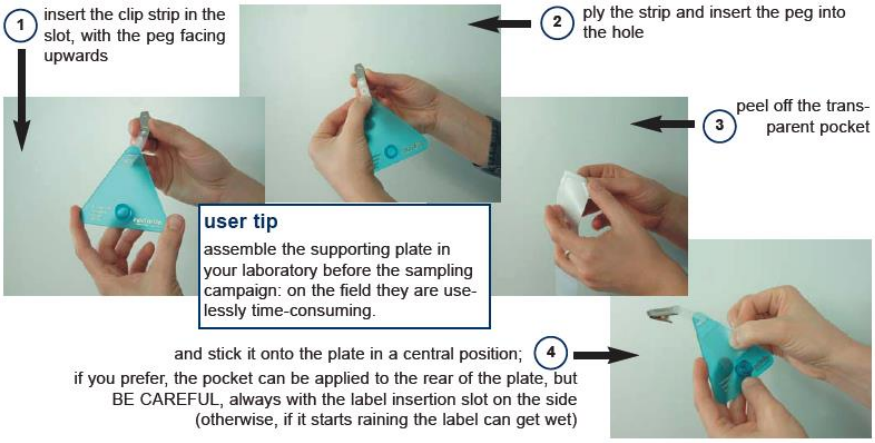
2.1 Assembly of Supporting Plate

Before using the Radiello, you have to assemble the supporting plate with the clip, to suspend it and the adhesive label pocket, as shown in the figures below:



The Sampling Methodology, cont'd

2.2. Preparation of Sample

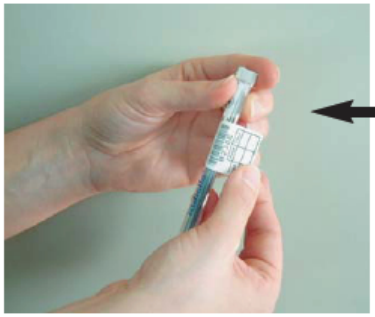


2.3 Placement of Samplers

Although the Supporting Plate with Diffusive Tube can simply be tied (using cable ties) on to the pole, it is advisable to shelter it from excessive wind, rain and sunlight, as shown in the figure below. A fairly simple alternative is to use an empty plastic ice-cream or yoghurt containers cut in half lengthwise. Strap the back of the container vertically to the pole using two cable ties (near the bottom and top). The Supporting Plate can similarly be tied to the pole inside the container, as shown in the illustration below.

The Sampling Methodology, cont'd

2.4 On Completion of Sampling Campaign



4

Keep note of the date and time of the end of exposure.

Place the cartridge into the tube, peel off the label and stick it onto the tube **such that the barcode is parallel to the axis of the tube.**

If you have performed the sampling of different polluting compounds at the same time, ***BE CAREFUL NOT TO MIX UP THE TUBES***: place the exposed cartridge in its original tube, identified by the code printed on the plastic bag.

3. Important Notes

- Assemble the supporting plate in your laboratory before the sampling campaign commences, as on the field this consumes time and introduces the risk of contamination.
- Even if you write the date and time the sampling process commenced and ended on the adhesive label, it is recommended that you to keep a record of these parameters elsewhere, in the event that bad weather conditions cause these inks to become illegible!
- DO NOT USE MARKING PENS to write on the label: they contain solvents that are sampled by Radiello.