

**Appendix A**

**URS Procedures Flux Emission Sampling**

## Fieldwork Procedure

### FLUX EMISSIONS SAMPLING

#### Introduction

This procedure outlines the approach to fieldwork for the collection of surface flux emissions samples, which are typically sent for laboratory analysis and further assessment. Surface flux emissions samples are collected from the surface of an undisturbed<sup>A</sup> surface using a static Flux Chamber (Flux Hood). This methodology enables the quantification of emissions to air from the surface of the ground without the influences of ambient air.

The methodology generally follows US EPA Guidance for Measurement of Gaseous Emission Rates from Land Surfaces Using an Emission Isolation Flux Chamber (US EPA, 1986 and Reinhart, 1992). This method is applicable to the measurement of air emission rates at the ground surface from undisturbed sites where contaminants have been released to the surface or subsurface (US EPA, 1986). The static flux hood method is listed as the preferred testing technique for the direct measurement of volatile organic compounds (VOC) vapour emissions by the US EPA in the Air/Superfund Technical Guideline Series (US EPA, 1990) and it is also included by the NSW EPA as test method OM-8 on the list of “Approved methods for the sampling and analysis of air pollutants in New South Wales” (NSW EPA, 2005). A photograph of the flux hood used by URS is shown in Figure 1.



**Figure 1 - Photograph of URS Isolation Flux Hood**

Once the sample is collected it is analysed by the selected laboratory for the key chemicals using the most appropriate analytical technique. The analytical technique should be able to provide a sufficiently low limit of detection as required for the outcome of the sampling program.

---

<sup>A</sup> Disturbed material maybe sampled using the flux hood when investigating emission profiles for turned or disturbed material, such as contaminated dredged sediment.

This procedure includes a description of the field testing, equipment and recording requirements, as well as health and safety issues associated with collecting the required samples.

## Health and Safety

The collection of flux emissions samples does not require any penetration of the ground surface, nor is the technique typically used within confined spaces. However all works undertaken should be in accordance with the site-specific Health, Safety and Environment Plans.

The methodology, however, does require the use of compressed gas cylinders. Hence transport of the cylinders must be undertaken using a utility with the cylinders transported in the open tray/back. In addition precautions must be taken to ensure safe handling, securing and storage of the cylinders on-site, within the vehicle and at any other off-site location.

## Sampling Methodology – Flux Hood

The following describes the approach for the collection of surface flux emissions samples using a flux hood:

- Any site clearances or access permission should be obtained prior to the start of fieldwork;
- The sampling locations should be determined prior to the fieldwork. The locations should be chosen to best reflect potential pathways of exposure. Where possible, the samples should be collected in areas that are likely to be preferential vapour migration pathways. These areas include gardens or other exposure soil areas, grassed areas or if sampling is to be undertaken on a sealed surface, then the samples should be collected from areas where there are visible cracks, service trenches etc;
- Since the sampling is being undertaken from the surface of the ground and soil moisture is a key factor influencing the availability of soil gas/ vapour emissions, then sampling should be undertaken after a minimum of 3 days of dry weather. In winter a longer period of time may be required to ensure surface and subsurface conditions are as dry as possible. A light 'sprinkle' of rain, which does not penetrate the surface of the ground, is not considered to be of concern if it occurs during the sampling. However, further rain, which is likely to penetrate the surface of the ground, may affect the results and therefore sampling should stop;
- Where possible sampling should be planned to collect samples from locations where low concentrations/emissions are expected first and sampling from areas of high concentrations/emissions should be undertaken last;
- All pumps used should be calibrated at the beginning and end of every sampling day and preferably at the beginning and end of every sample location;
- The flux hood should be wiped clean or decontaminated (outside only) as per URS standard operating procedures prior to sampling (equipment may have been contaminated during transport or storage or previous work). Generally a wipe with a dilute solution of Decon90® followed by wipe with filtered water is sufficient to

clean the flux hood. Care must be taken to ensure Teflon tubing is not wet as it will not dry and the moisture may compromise sampling and analysis. Cleaning the flux hood between locations is generally not considered to be necessary, unless it becomes dirty (with contaminated materials) during the sampling;

- At each location the flux hood shall be placed on the surface of the ground. In areas where there is exposed soil, the flux hood should be gently pushed into the surface soils, with the rim being approximately 2-3cm below the surface of the ground. In areas where the soils are not exposed, a seal of clean sand (or site soils representative of the area being sampled) can be used around the base of the flux hood;
- Once placed at the desired location, then the flux hood must be purged and allowed to establish equilibrium. This requires the connection of the sweep gas (ultra high purity nitrogen<sup>B</sup>) to the sweep inlet of the flux hood using flexible Teflon tubing. The sweep gas should be set at 2.5L/min and at least 4 flux hood volumes purged. This may take 24 to 48 minutes<sup>C</sup> depending on the volume of the flux hood and the sweep gas flow rate. Purging/flushing is only required at the establishment of each location. It does not need to be repeated between sample collection at the same location. Purging/flushing must be undertaken if the sampling location is changed;
- The sweep gas must remain constant throughout the purging and sampling;
- Ensure the pressure valve of the flux hood is open to ensure that a significant positive pressure does not build up within the flux hood. This valve (opening) is to remain open throughout the sampling;
- The temperature inside the flux chamber should be recorded prior to and at the completion of sampling;
- The collection of a sample into the desired sampling media (sorbent tube, summa canister or tedlar bag) should be performed by connecting a flexible Teflon sampling tube<sup>D</sup> between the flux hood sampling port and the sampling media<sup>E</sup>. The sampling media and sampling time should be determined prior to the collection of the samples and must reflect the objectives of the sampling program. The sampling flow rate should be set at a rate typically determined by the sampling media, however the rate must not exceed 40% of the sweep gas flowrate to ensure that a slight positive pressure is maintained and ambient air is not drawn into the flux hood;
- The sampling flow rate should be measured and monitored during the collection of the sample using a flow meter (generally placed in series between the sampling media and the pump);

---

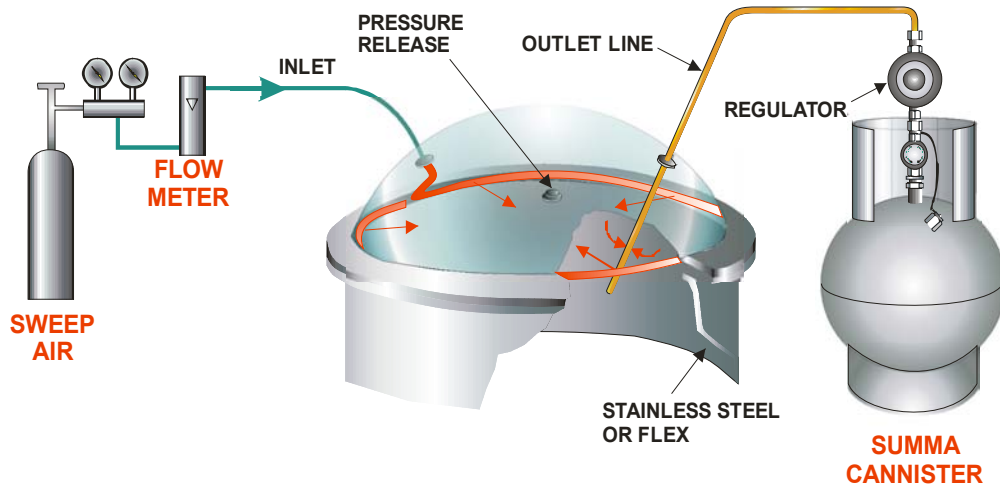
<sup>B</sup> Where flux hood is being used to collect odour samples, industrial grade nitrogen is sufficient.

<sup>C</sup> Given the flux hood volume of 30 L and an (input) nitrogen flow rate of 5 L/min, one purge volume should be take 6 minutes and four purge volumes, 24 minutes. A sweep gas flow of 2.5L/min would double this purge time.

<sup>D</sup> New teflon tubing between each sample location is not compulsory, however, where high concentrations of VOC are likely, new tubing for each sample is recommended.

<sup>E</sup> The connections for the ports are generally ¼" Swagelok fittings.

- Where sampling is undertaken using sorbent tubes, duplicate samples (preferably sampled in parallel) should be taken at different volumes. This gives the laboratory the ability to analyse the duplicate sample in the event that unexpected high concentrations are reported.
- A schematic of the sampling procedure is shown in Figure 2.



**Figure 2 - Schematic of Sampling using the Isolation Flux Hood**

## Calibration

- Sampling Tube Calibration
  - All pumps used should be calibrated at the beginning and end of every sampling day and preferably at the beginning and end of every sample location;
  - Connect pump to sampling tube using silicon tubing (ensuring an air tight seal) or appropriate Swagelok™ fittings;
  - Connect the flow calibrator to the inlet end of the sampling tube;
  - Following the manufacturers instructions, adjust the flow on the pump until the desired flow is achieved consistently for a short period of time (~30 seconds);
- PID and LEL should be calibrated daily prior to work starting against known standards. Calibration should be performed as per manufacturer's instructions.
- Calibration not required if sampling with Summa Canisters

## Documentation and QA Requirements

- Information which must be recorded during each sampling event includes:

- time and date;
  - location;
  - description of the sampling location (i.e. soils, vegetation, landuse, type of buildings etc.) and type of sample collected;
  - weather conditions/observations;
  - sampling media and ID;
  - sweep air flow rate (L/min);
  - purge time (min);
  - sampling rate (L/min);
  - sampling time (minutes);
  - temperature inside flux hood at start and finish of sampling;
  - odour, presence of any moisture within the flux hood or any other observations.
- The unused storage time and conditions of each sampling media (particularly sorbent tubes and summa canisters) must be determined and the media must not be stored for longer than the maximum time prior to sampling;
  - Once samples are collected on site, they should be prepared for analysis at the relevant laboratory. This procedure shall ensure the integrity of the samples and includes:
    - Ensuring the end-caps of the samples (where tubes are used for sampling) are replaced and are firm (as required) at the completion of the collection of each sample;
    - Tedlar bags should not be used if transport the laboratory required air freight;
    - Samples should be kept in a cool, dry place (as required for the relevant sampling media) following collection and at all times up to shipment to the laboratory;
    - Maximum storage time should not exceed 48 hours following collection of the samples to submission to the laboratory. With the transporting of samples overseas, transportation time must be taken into consideration to ensure the samples do not exceed certification periods;
    - A COC must accompany the samples sent to the laboratory.
  - Field QA samples must also be collected. These include:
    - Analysis of a field blank. The collection of a field blank should be collected in the same manner as the primary samples. The flux hood should be placed onto clean (not contaminated) Teflon sheeting or a Tedlar Bag. A sample should be collected onto the same sampling media for the same period if time as the primary samples.
    - Sampling and analysis of one duplicate sample per day or every 10 samples collected;

- Collection and analysis of one sweep gas sample (to determine integrity of sweep air). This measurement, whilst not compulsory, would be useful where UHP sweep gas is not available;
- Analysis of one trip blank and one trip spike (where possible) per sampling round. Note: trip blanks and trip spikes are generally not performed when using summa canisters.

## Equipment Required

Listed below is the equipment required to conduct soil gas sampling:

- Flux hood;
- Sweep gas – D size, ultra high purity nitrogen (99.999% pure);
- Flexible Teflon tubing (sufficient for the sampling required);
- Air flow calibrator;
- Air temperature meter;
- Decon solution;
- Sampling media (sorbent tubes, summa canisters or tedlar bags);
- Sampling pump/s (fully charged and pre-tested with relevant media to ensure flow rates and sampling times can be achieved);
- Swagelok fittings;
- Shifting spanners;
- Esky (as ice bricks as required for keeping sorbent tubes at an appropriate temperature);
- Camera;
- Notebook;
- Health and Safety Plan and appropriate field notes;
- Health and Safety equipment required by HSEP;
- Site map and sampling plan.

PREPARED BY: Martin Treloar

REVIEWED BY: Stephen Bowly

AUTHORISED BY: Stephen Bowly

DATE: 4 June 2007