

# **Indoor Air Remote Sampling Procedure, Background Information ESM 552,**

## **Residential Air Pollution:**

The air in our homes and workplaces is always 2 - 5 times, and in some cases 100 times, more polluted than the worst outside air". Most people spend between 90 - 95% of their time indoors; breathing in closed and seriously polluted indoor air. It is believed that indoor air quality is getting worse and those indoor air quality pollutants measurements are the fastest growing segment of the pollution monitoring industry.

It is important to realize that a significant amount of education must be done to help people understand the causes of indoor air pollution and the remedy. There are a wide variety of promotional and educational tools, to help people understand the issues and the cures.

## **Experimental Design**

When designing your air sampling study there are several things that you have to consider.

- 1) What are the types of pollutants you are interested in?
- 2) Is this a qualitative or quantitative study?
- 3) How are the samples going to be analyzed?
- 4) What are the expected levels?
- 5) How much sample needs to be collected?

1) For this lab we are interested in organic pollutants in indoor air. We will be using an air sampler with detector tube to sample indoor air. A detector tube is a hermetically sealed glass tube containing an inert solid or granular material such as silica gel, alumina, resin, ground glass, or graphite granules. The tube used in these experiments contains activated carbon and was specifically designed for purpose of collecting organic molecules in the air. The tube has two sections of graphite granules, a large front section and a small rear section. The tube is always oriented with the small carbon bead end inserted into the pump tubing. This is a secondary bead that is only evaluated for breakthrough if the sample is extremely concentrated at your location.

2) For a quantitative the air sample is drawn into and through the tube and into the pump, until an exact volume of sample pumped. The pump flow must be calibrated by a NIST traceable calibrated mass flow meter for certified measurement according to EPA regulations. When using a detector tube and a portable air sampler for air sampling the flow rate changes as the activated

carbon becomes loaded with sample. To correct for this the flow is checked before and after sampling, and an average flow rate for the sampling period is calculated. For this lab we will be performing a qualitative analysis, so calibration is not necessary.

**3)** The amount of sample that has to be collected is dependent on the analysis technique. For this lab we will be using an ion-trap GC/MS. The limit of sensitivity for this instrument in qualitative analysis mode (full scan all masses) is about 50 ng. This means that for the 1 $\mu$ L injection volume there must be at least 50 ng present or it will not be detected.

**4 & 5)** The sample time and flow rate will vary depending on where you are sampling and what the expected concentration range is. For example if you are sampling the air quality at an auto repair shop with no air conditioning and fuel pumps near by you would expect the concentration of organic compounds to be high. In this case you might only have to sample for 2-3 hours to collect enough sample on the activated carbon to analyze. If you were sampling in an office or a room in your home where the levels are expected to be low you might have to sample for 8 hours to collect enough sample.

### **Sample Collection with Air Sampler**

You should prepare a brief history of the house, office and room to the best of your ability to assist with the data analysis and to assist in evaluating the significance of the findings. You should record all site information.

Example of data recorded: Pump A, channel 1. or Pump A, channel 2., Date, time hh:mm, and taken by "your name" and where or location. Also record the air temperature at that location if possible.

Note: a piece of masking tape or a label of some sort should be affixed to each tube and a written description should be prepared to accompany each sample set (two simultaneously processed tubes).

### **HOW THESE SAMPLE WILL BE ANALYZED**

#### **Sample Preparation for GC/MS Analysis:**

The graphite granules will be removed from the tube front sections and placed on a small filter paper in side a funnel. You will be assisted with this step and given additional instructions in the laboratory. A small amount of solvent such as toluene or hexane is added to the granules. A vacuum is used to filter off the solvent and the pollutants adsorbed to the granules are transferred to the solvent. The filtrate (solvent) is collected in a small vial use for GC-MS analysis. After the collection the vial is capped and sealed tight to prevent any lose of the volatile materials. The vial cap has a septum that will be pierced by a needle in the auto sampler of the GC/MS so the vial may be sampled more than once if necessary.

## **GC/MS Analysis:**

The analysis is done for all the collected samples (after filtration) in the same session overnight. The data will be analyzed where a library search will be performed to identify the pollutants collected in student selected indoor locations. The theory of the GC/MS will be provided in class and specific instructions will be provided in the laboratory for a trial run during the laboratory class. Data from the GC/MS will be returned to you with additional instructions to assist you in the preparation of your laboratory paper.

## **Sampling Instructions:**

### **HOW TO USE THE AIR PUMP AND TAKE YOUR SAMPLES**

- 1.** The group members of each cooperative learning group should decide where you wish to take the samples. You should use the unit at least once per group to take an appropriate set of samples.
- 2.** The air sampler works best when the power is supplied by the charger. If there is no outlet available then the sampler can be run off battery power. (Note the batteries seem weak so use the charger and keep it plugged in to take the samples)
- 3.** Before sampling both ends of the sampling tube must be broken off. This is done just before it is hooked to the tubing of the pump. This unseals the carbon collection media of the tube. Because you may be unfamiliar with this process you may want to practice on the larger volume side first as it is the small end of the tube that will be attached to the tubing. A file used to score the tube before breaking it with fine pliers is one of the best ways to assure a good and clean break. If this is a problem and you have broken too much glass and the tub will not fit the only remedy that I can suggest is to possibly use some parafilm to make the connection to the pump tubing. This is why you have two extra tubes that you probably do not need and will return.
- 4.** Setting Timer. The electronic timer has five 10 position rotary switches. The left edge switch must be set on C for the timer to function. The center 3 switches are for setting run time. The right switch is the time range. Use M for minutes, H for hours, S for seconds. Set an appropriate sampling time based on expected concentration and location.
- 5.** To turn on the pump, turn on the on/off switch, and then press the green button after the sampling tubes are connected (pressure fit to the tubing). When the pump has turned its self off automatically after sampling (set your own time, for example: one or two hours, see above discussion).
- 6.** Place the pump out of a direct draft in a dead air section of the room. The samples can be taken from any location in the room. Also record the location in the room where you have decided to take the samples.

7. Once you are finished taking your sample you need to pass the charger and pump unit to the next person in your group or on to the next group. [Make these arrangements in class before leaving]

8. Return the unit (including charger and sample tubes to class during the next class meeting or after you are finished collecting your air samples. The proper number of tubes will be provided to the groups including two extra tubes.

### DIAGRAM OF THE AIR SAMPLER (SUPELCO)

