

## MEMORANDUM

To: AIR QUALITY CONSULTANTS

From: John Sliwinski  
OSB Lab

Re: Scrubbing Out Sulphur Dioxide  
Laboratory Tests

Date: 02.09.12

The attached Comparisons of Chromatograms illustrate the effect of Sodium Carbonate traps on scrubbing out SO<sub>2</sub> and recovering VOCs. Sulphur Dioxide is removed chemically by reacting with Na<sub>2</sub>CO<sub>3</sub> to form stable salts Na<sub>2</sub>SO<sub>3</sub> and Na<sub>2</sub>SO<sub>4</sub> depending on presence of air. Cold Na<sub>2</sub>SO<sub>3</sub> traps do not absorb low boiling VOCs but do condense high boiling VOCs above Toluene b.p. Experiments have been carried out using odourless mineral spirits CAS No. 64742-48-9 b.p. 176-204°C and Naphthalene b.p. 218°C which show that Na<sub>2</sub>CO<sub>3</sub> traps do not condense VOCs when heated at 120°C or greater but still react with SO<sub>2</sub> to remove it effectively.

Initial tests were carried out using a sample from a source exhausting a coal-fired combustion system. The sample was split and one portion was transferred through a cold (room temperature) Na<sub>2</sub>CO<sub>3</sub> trap. The transferred sample, the heated (desorbed) trap and the unaltered split sample were all analyzed (00109c-21).

RUN	OBSERVATIONS
1NOV1312	The unaltered split sample shows large amount of SO <sub>2</sub> and complete range of VOCs for reference.
1NOV1307	The cold trap transferred split sample shows complete elimination of SO <sub>2</sub> , good recovery of low boiling VOCs but a substantial loss of high boiling VOCs including Naphthalene.
1NOV 1309	The thermally desorbed Na <sub>2</sub> CO <sub>3</sub> trap shows that SO <sub>2</sub> is not released but all condensed semi-VOCs are recovered from the cold trap. Even Dibenzofuran is released upon heating.

Additional tests were carried out to determine how SO<sub>2</sub> and VOCs behaved while being transferred through a heated Na<sub>2</sub>CO<sub>3</sub> trap- at 120°C. A 50ppm Scott SO<sub>2</sub> gas cylinder was used as the source of Sulphur Dioxide, and a standard Tedlar gas bag was prepared with Naphthalene dissolved in odourless mineral spirits. Samples were analyzed under different conditions using C analytical tubes (01043b).

RUN	OBSERVATIONS
2FEB0503	200mL SO <sub>2</sub> gas through trap at 120°C. Sulphur Dioxide was removed.
2FEB0505	5mL SO <sub>2</sub> gas spiked without trap. Sulphur Dioxide recovered.
2FEB0506	100mL SO <sub>2</sub> gas spiked without trap. Sulphur Dioxide recovered.
2FEB0507	300mL SO <sub>2</sub> gas spiked without trap. Sulphur Dioxide recovered.
2FEB0508	250µL standard spiked without trap is recovered. Sulphur Dioxide is a carryover contaminant from previous run.
2FEB0509	1mL standard and 300mL SO <sub>2</sub> gas spiked through trap at 120°C. Sulphur Dioxide was removed but standard was recovered.
2FEB0510	4mL standard and 400mL SO <sub>2</sub> gas spiked through trap at 120°C. Sulphur Dioxide was removed but standard was recovered. Note 1-Tetradecene from high mineral spirits injection.

## TEST RESULTS

RUN	TRAP °C	SULPHUR DIOXIDE		MINERAL SPIRITS		NAPHTHALENE	
		µg	Response Area	µg	Response Area	µg	Response Area
0503	120	26.58	9.03	—	—	—	—
0505	None	0.665	38.8	—	—	—	—
0506	None	13.29	543.4	—	—	—	—
0507	None	39.87	2193	—	—	—	—
0508	None	0	142	3.235	496.3	0.094	5.93
0509	120	39.87	66.5	12.94	2443	0.374	24.8
0510	120	53.16	83.1	51.76	5195	1.497	134.2

The data presented above is demonstrative in nature. Concentrations were selected to cover a broad range challenge not necessarily within the operating limits of the MSD. The smaller injection Naphthalene was used to monitor detection sensitivity.