



TECHNICAL NOTE

METHAMPHETAMINE WIPE SAMPLING TECHNIQUES

When sampling for methamphetamine and its precursors on surfaces using methanol moistened wipes, there are a number of sampling techniques that have been developed by the National Institute for Occupational Safety and Health (NIOSH) and the industry:

1. Individual sample technique
2. Single-wipe field composite technique
3. Multi-wipe field composite technique
4. Laboratory composite technique

This technical note describes the strengths and weaknesses of each technique, and how the results can be interpreted. Techniques 2-4 have been developed to keep the costs of a screening investigation to a minimum. Table 1 summarises the strengths and weaknesses of each wipe sampling technique, which are discussed in detail below.

Table 1: Summary of Strengths and Weaknesses for each Wipe Sampling Technique

| Sampling Technique | Strengths | Weaknesses |
|------------------------------------|--|---|
| Individual Sample | NIOSH 9111 compliant, each result can be compared directly with the regulatory limit. | Most expensive option. |
| Single-Wipe Field Composite | Cheap, sensitive, indicative. | Not NIOSH 9111 compliant, cannot be directly compared with the regulatory limit. |
| Multi-Wipe Field Composite | Cheap, sensitive, a result less than the regulatory limit means compliance. | Re-sampling required if the result is in the "grey area" (distribution of Meth by area in the dwelling needs to be determined). Lab must increase the extraction volume to account for the extra wipes to be NIOSH 9111 compliant (processing must occur outside of a standard sampling tube). |
| Lab Composite | Cheap, a result less than the corrected regulatory limit means compliance, individual samples can be analysed if result is in the "grey area" without re-sampling. | Correction required for comparison against the regulatory limit, explaining the result to the general public. |

Background – NIOSH 9111 Sampling Technique

The Ministry of Health (MoH) Guidelines for the Remediation of Clandestine Methamphetamine Laboratory Sites (2010)¹ specify that the determination of methamphetamine residues must be undertaken using laboratory-specific methods (Table 4). The approved methods can be one of the following NIOSH standard methods: 9106, 9109 or 9111. At the present time, the most common method for analysing wipe samples is NIOSH 9111.

The wipe sampling technique described in NIOSH 9111 is as follows:

1. *Using a new pair of gloves, remove a gauze wipe from its protective package. Moisten the wipe with approximately 3 to 4 mL of methanol (or isopropanol).*
2. *Place the template over the area to be sampled (may tape in place along outside edge of template). Wipe the surface to be sampled with firm pressure, using vertical S-strokes. Fold the exposed side of the pad in and wipe the area with horizontal S-strokes. Fold the pad once more and wipe the area again with vertical S-strokes.*
3. *Fold the pad, exposed side in, and place in shipping container and seal with cap.*

In other words, each 100cm² area must be wiped three times with the same wipe, presenting a new surface of the wipe with each pass.

¹ <https://www.health.govt.nz/system/files/documents/publications/guidelines-remediation-clandestine-meth-lab-sites.pdf>

Individual Sample Technique

The individual sample technique involves wipe sampling according to the NIOSH 9111 protocol (one wipe per 100cm²). The strengths of this technique are that it is NIOSH 9111 compliant, and each result can be compared directly with the regulatory limit. The weakness of this technique is that it is the most expensive option as each part of the property needs to be sampled and analysed separately.

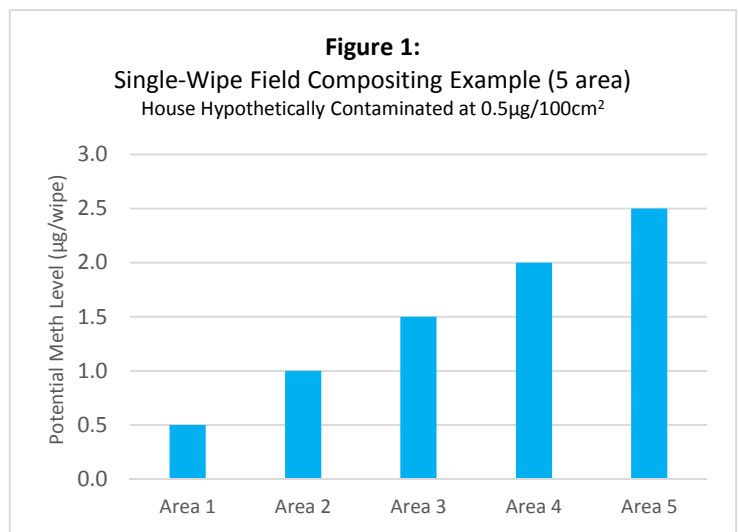
Single-Wipe Field Composite technique

The single-wipe field composite technique involves using one wipe to sample multiple areas such that each 10cm x 10cm area is only wiped once (or twice in some instances). The result represents a *sum or accumulation* of Meth. The strengths of the technique is that it is significantly cheaper than the individual sample technique, the results are indicative of the levels of contamination in the property, and a non-detect is very good evidence that no methamphetamine related activity has occurred in the dwelling (because it is so sensitive). The weaknesses are that it is not compliant with NIOSH 9111 (because each area is only wiped once), and the result can't be directly compared with regulatory limit (because it is not NIOSH 9111 compliant, and the area sampled will be greater than 100cm²).

An example of the field composite technique is presented in Figure 1. Let's assume that a particular dwelling is evenly contaminated at a level of 0.5µg/100cm². Wiping a 100cm² area in that dwelling once would result in a maximum amount of 0.5µg on the wipe. If we now take that wipe and sample another area, an additional 0.5µg will be added to that wipe. If we carry on to sample an additional three areas (five in total), the wipe could potentially contain 2.5µg.

Note that the figure of 2.5µg is only a theoretical maximum because one wipe using a methanol swab results in only 81-87% of methamphetamine being recovered².

Note also that the result of 2.5µg has actually been sampled from an area of 500cm², so the result is in fact 2.5µg/500cm². For both of these reasons, the result cannot be directly compared with the regulatory limit.



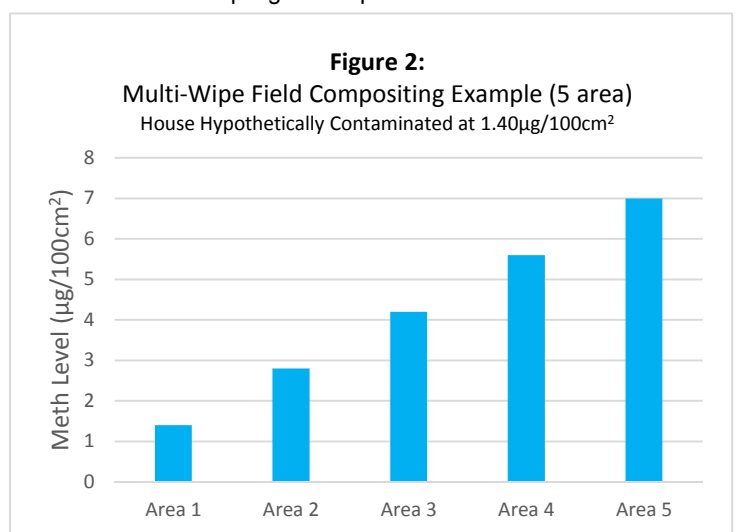
Multi-Wipe Field Composite technique

The Multi-wipe Field Composite technique is where individual wipes are taken from 100cm² areas according to the NIOSH 9111 technique, but then are put in to one tube and submitted to the laboratory for analysis. Like the Single-wipe Field Composite technique, the result represents a sum or accumulation of Meth on the wipes in the tube, but unlike that technique, the result can be compared (with care!) against the regulatory limit because the correct sampling technique is used.

For example, If the result of the Multi-wipe Field Composite is less than a regulatory limit (for example less than 1.5µg/100cm²), there can be no one wipe in the composite that exceeds that limit, and therefore the dwelling can be said to be compliant.

However there is a grey area of where the dwelling *may not* comply with the regulatory limits. Refer to Table 2 for some grey area calculations. Results in the grey area will require resampling to determine compliance against the regulatory limit.

As can be seen from Figure 2, a result of 7µg/100cm² from a Multi-Wipe Field Composite does not necessarily mean that the dwelling exceeds the regulatory limit because the concentration of the individual areas are only 1.40µg/100cm². A result greater than 7.45µg/100cm² however, means that there must be at least one area in the dwelling that exceeds 1.49 µg/100cm² and therefore does not meet the limit.



² NIOSH 9109, Table 10a. Methanol is the best solvent. Even though Isopropyl alcohol is an allowed solvent, one wipe only recovers between 58-75% of the methamphetamine.

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The strengths of the Multi-Wipe technique are that in addition to the strengths of the Single-Wipe technique, the result can be compared with the regulatory limit because it is NIOSH 9111 compliant. The weakness is the grey area where re-sampling will be required using the individual sample technique in order to determine if there are areas that exceed the regulatory limit.

Table 2: Table of Compliance for Multi-Wipe Field Composites with a Regulatory Limit of 1.5µg/100cm²

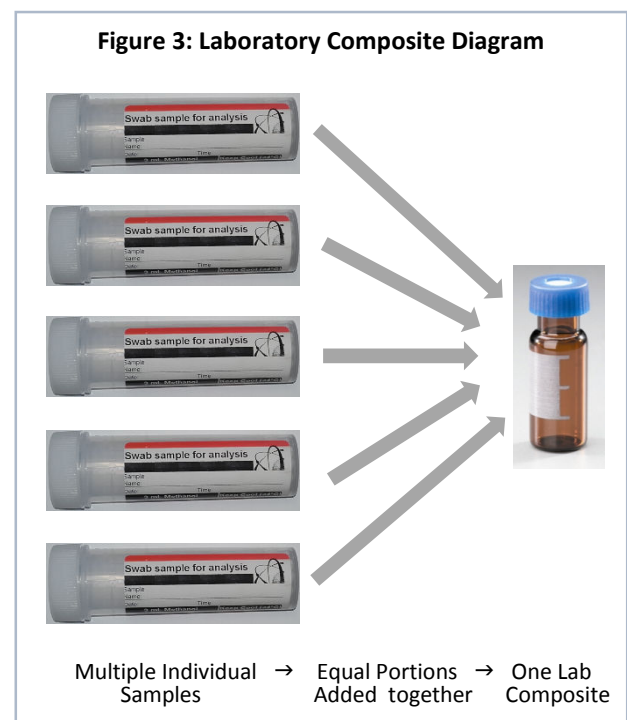
| Number of Wipes in the Field Composite | Compliant Result | “Grey Area” | Non-Compliant Result |
|--|------------------|-------------|----------------------|
| 2 | < 1.5 | 1.5 – 2.98 | > 2.98 |
| 5 | < 1.5 | 1.5 – 7.45 | > 7.45 |
| 10 | < 1.5 | 1.5 – 14.9 | > 14.9 |

An issue for laboratories with this technique however is that the NIOSH standard methods require the volume of extractant to increase according to the number of wipes in the composite (NIOSH 9111 section 7a, and NIOSH 9109 Appendix D3). The latter method requires a field composite of 4 wipes to have an extractant volume of 80mL. If the volume correction is not done, then it could be argued that the NIOSH reference methods for analysis have not been followed and therefore direct comparison with the Guidelines can no longer be made.

Laboratory Composite technique

The Laboratory Composite technique is where individual wipe samples are taken according to the NIOSH 9111 technique and sent to the lab for analysis³. The lab extracts each sample as an individual in the first instance, but then combines equal portions of the extracts to form a new sample called a lab composite. Only the new lab composite sample is analysed on the instrument, and the result represents an average concentration. The process is represented pictorially in Figure 3.

The strengths of the Lab Composite technique are that it is NIOSH 9111 compliant, it is significantly cheaper than individual sample analysis (although a little more expensive than the Field Composite because of laboratory composite fees and additional time taken for sampling), the result of composite can be compared with the regulatory limit once a correction for the compositing is done, and finally if a positive is found, a request can be made to the laboratory to analysed the individual samples if required⁴ without having to return to the dwelling to re-sample. The main weaknesses of the technique are understanding the correction required, and explaining the result to the general public.



³ Laboratory Composites are indicated on the request form by bracketing the samples to be composited (i.e. }) and then writing “Composite” next to the bracket.

⁴ Individual Meth wipe samples are generally kept for one month before being discarded.

There are two ways of carrying out the correction:

1. Calculating the theoretical (potential) maximum

As mentioned before, the lab composite result represents the *average concentration* across all samples, because equal portions of each of the extracts are added together. This means therefore, that the theoretical maximum in any one sample can be calculated by multiplying the lab composite result by the number of samples in the composite itself.

Example:

- A five-sample Lab Composite sample returns a result of 0.29µg/sample. The theoretical maximum in any one of the samples is therefore $0.29 \times 5 = 1.45\mu\text{g}/100\text{cm}^2$. If the regulatory limit is $1.5 \mu\text{g}/100\text{cm}^2$, it means that none of the areas sampled in the dwelling exceed the limit.

The Theoretical Maximum calculation is included in all Hill Laboratories reports containing lab composite Meth samples (see example report below).

2. Dividing the Regulatory Limit by the number of samples in the composite

The second method is to divide the limit by the number of samples in the composite, and then comparing the Lab Composite result against the corrected limit.

Example:

- A five sample Lab Composite sample returns a result of 0.34µg/sample. Does this meet a regulatory limit of $1.5\mu\text{g}/100\text{cm}^2$? The corrected regulatory limit would be $1.5 \div 5 = 0.3\mu\text{g}/100\text{cm}^2$. Because 0.34µg/sample exceeds $0.3\mu\text{g}/100\text{cm}^2$ then it is theoretically possible that one sample would exceed the limit if it contained all of the contamination. Another option is that each of the individual sample results are all 0.34 µg/sample!

It can be seen then, that just as the Multi-Wipe Field Composite has a “grey area” of results, so does a Lab Composite. Refer to Table 3 for some grey area calculations. Results in the grey area will require de-compositing by the lab⁵ to determine compliance against the regulatory limit, but unlike the Field Composite technique, re-sampling for this step is not required.

Table 3: Table of Compliance for Laboratory Composites with a Regulatory Limit of 1.5µg/100cm²

| Number of Samples in the Lab Composite | Compliant Result | “Grey Area” | Non-Compliant |
|--|------------------|-------------|---------------|
| 2 | < 0.75 | 0.75 – 2.98 | > 2.98 |
| 5 | < 0.3 | 0.3 – 7.45 | > 7.45 |
| 10 | < 0.15 | 0.15 – 14.9 | > 14.9 |

An example of a Lab Composite report is presented below (Figure 4). As can be seen on the report, the Lab Composite is actually sample 12345678.9 even though only samples 12345678.1-8 were sent to the lab. This is because the Lab Composite sample is created in the Lab. It is worth noting that the report will be issued in two versions:

1. Version 1 will only have the results of the Lab Composite.
2. Version 2 will have the results of the individual samples and is actioned by request.

The example chosen is of a “Version 1” report and only contains the result of the Lab Composite.

Because the Potential Maximum result is below $1.5\mu\text{g}/\text{sample}$, the job does not require “decompositing” (analysing the individual samples in the job).

The example in Figure 5 (over the page) however shows a “Version 2” report where the Potential Maximum exceeded $1.5\mu\text{g}/\text{sample}$ so the job was decomposited. It is interesting to note that most of the contamination is concentrated in one sample (Bedroom 1) which is not unusual to see.

Figure 4: Example Report for a Lab Composite

| Sample Type: Methamphetamine Composite Sample Fraction | | | |
|--|-----------|---|---|
| Sample Name: | | Composite of Kitchen, Lounge, Laundry, Downstairs Bathroom, Bedroom 1, Bedroom 2, Bedroom 3 & Bedroom 4 | |
| Lab Number: | | 12345678.9 | |
| Methamphetamine & Precursors Laboratory Compositated Sample | | | |
| Amphetamine | µg/sample | < 0.02 | - |
| Ephedrine | µg/sample | < 0.02 | - |
| Methamphetamine | µg/sample | 0.12 | - |
| Pseudoephedrine | µg/sample | < 0.02 | - |
| Methamphetamine Potential Maximum in Single Wipe (ug/sample) | | | |
| Methamphetamine | µg/sample | 0.96 | - |

⁵ Requests for decompositing of particular jobs should ideally be made to the lab via email.



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Figure 5: Example Report for a Lab Composite with Decomposed Sample Results

| Sample Type: Miscellaneous Wipe | | | | | | |
|--|---|-------------------------------------|--|-----------------------------------|---------------------------------------|--------|
| Sample Name: | Bedroom 1 06-Jul-2017 2:39 pm | Bedroom 2 06-Jul-2017 2:39 pm | Room with fireplace 06-Jul-2017 2:40 pm | Kitchen 06-Jul-2017 2:40 pm | Dining room 06-Jul-2017 2:41 pm | |
| Lab Number: | 12345.1 | 12345.2 | 12345.3 | 12345.4 | 12345.5 | |
| Methamphetamine Including Precursors on Wipes by LCMSMS | | | | | | |
| Amphetamine | µg/sample | 0.06 | < 0.02 | < 0.02 | < 0.02 | < 0.02 |
| Ephedrine | µg/sample | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 |
| Methamphetamine | µg/sample | 2.9 | 0.02 | 0.47 | 0.09 | 0.07 |
| Pseudoephedrine | µg/sample | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 |
| Sample Type: Methamphetamine Composite Sample Fraction | | | | | | |
| Sample Name: | Composite of Bedroom 1, Bedroom 2, Room with fireplace, Kitchen, Dining room | | | | | |
| Lab Number: | 12345.6 | | | | | |
| Methamphetamine & Precursors Laboratory Compositated Sample | | | | | | |
| Amphetamine | µg/sample | < 0.02 | - | - | - | - |
| Ephedrine | µg/sample | < 0.02 | - | - | - | - |
| Methamphetamine | µg/sample | 0.74 | - | - | - | - |
| Pseudoephedrine | µg/sample | < 0.02 | - | - | - | - |
| Methamphetamine Potential Maximum in Single Wipe (ug/sample) | | | | | | |
| Methamphetamine | µg/sample | 3.7 | - | - | - | - |