

International Medical & Laboratory Protocol

After an incident with suspected cabin air contamination it is in your own best interest to compile a complete medical documentation, including diagnosis in case of subsequent medical problems that may require a work related injury record.

Immediate Action after Exposure

First blood and urine samples must be taken within 2 - 3 hours, at the very latest 48 hours. Best tell the medical personnel that the emergency is based on a possible '**poisoning**' by **inhalation of thermally degraded substances containing CO fumes**'.

Some of the tests must be done within the 2-3 hours, since those particular values tend to change very quickly - they can sink to 50% of the initial value within 4-5 hours - doctors would know this. At the very least get the blood drawn and save several samples of blood and urine. (*check details further down*)

The following list shows which values should be analysed within a 2 hour frame:

- Complete blood count (CBC)
- White blood count (WBC) and differential
- Liver transaminases
- Creatine kinase with isoenzymes (*AChE determination*)
- COHb (Carboxyhemoglobine) determination for forensic purposes (**within 2 hours, more info below**)
- Blood gas analysis/earlobe blood gas analysis (**within 2 hours**)
- Oxygen saturation (**within 2 hours**)
- AChE (**read info further down**)

Metabolic parameters such as cholesterol and sugar can be omitted.

Warning: *smoking may impact the measurments, please advise the medical personel when you had your last cigarette.*

Have all symptoms such as i.e. change of heart rhythm, shortness of breath and vision problems examined and documented. .

COHb - Carbon monoxide-saturated hemoglobin for forensic purposes.

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In forensic investigations, there are occasional incidents in which the circumstances seem to point irrefutably to carbon monoxide poisoning, but the blood analysis shows low or normal COHb levels. For the investigation of low-level exposure more sensitive methods involving the release of carbon monoxide and its measurement by gas chromatography are required. For this type of measurement the blood must be sampled on the day of the event, since the half-life is only 245 minutes and therefore the values may be back to normal the following day. It is vital that samples that are not to be dealt with immediately are stored correctly. As little air as possible should be left in the tube and the samples should be placed in a deep freeze without delay, irrespective of the anticipated degree of carboxylation.

AChE - (= red blood cell acetylcholinesterase activity) this measurement should not be an issue in a larger clinic/emergency room/university hospital and should also be done on the same day. Preferably previous measurements without/before exposure are available for comparison - but this will most often not be the case. You might get it done anyway, just in case another event happens - then you do have a comparison!

How to take and store blood & urine samples

***Important:** Desinfection of the skin area should not be carried out with solvent-containing disinfectants before sample collection, but e.g. with a three-percent aqueous hydrogen peroxide solution. (AMR 6.2); if not available, please note the name of the disinfectant used.*

Blood:

2 x 30 ml EDTA blood should be taken in clinical chemistry tubes and stored in the **deep-freezer (should be minus 20°C/ -4°F)** for further (resp. later) toxicological analyses.

Urine:

Each sample should have about 15ml. Three (3) urine samples on the first day - then over the next five days one (1) sample per day, (on these days use the first urine in the morning after getting up), these are also to be stored in the freezer. Special sterile cups can be obtained in pharmacies; if not available, use clean bottles/containers which can be closed airtight.

Reminder - Important: Some of the body fluid tests must be done straight after exposure (<8 within 2-3 hours) as the values deteriorate within 4-5 hours!. At least get the blood drawn and save some samples of blood and urine and store them in the **deep-freeze, if possible at minus 20°C (-4 °F)**.

Long Term Effects - an Overview

Some, or all symptoms may disappear within hours or days and you will feel fine again. But there is also the possibility of symptoms persisting 'on and off', especially

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if you are flying as usual. So called 'low level' contamination, meaning: exposure to some constantly present residues in carpets, seats and on the interior walls, and/or unnoticed small leaks can build up a so called 'toxic body burden' and symptoms reappear - often these symptoms will, when you are at home, have a few days off or are on holiday will seem to disappear and you feel better. Symptoms should be continuously documented and medically supervised. A diary with copies of findings should be kept.

Some long-term symptoms can be:

- Fatigue
- Memory loss
- Concentration issues (brain fog)
- Word finding problems
- Vision issues
- Headaches (recurring)
- Muscle weakness
- more [here](#)

When long-term effects/symptoms persist tests can be made for (within +/-30 days):

- Small Fiber Neuropathy
- Cognitive testing (memory, word finding issues, concentration etc)

When respiratory function tests become necessary due to ongoing respiratory issues:

- Respiratory orientated exercise test with spirometry pre and post
- Lung Ventilation (TLC, RV, FRC AND VC).
- Diffusion (TLCO and TLNO).
- Blood gas analysis/earlobe blood gas analysis
- Oxygen saturation
- ECG (i.e. cardiac arrhythmia)

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It is possible to have so called BIO-MONITORING done after (fumes) exposure (samples taken on the same day). The following substances could be present:

In the blood:

- 2-Butanon/MEK
- Isopropanol
- n-Heptane
- Isohexane/2-Methylpentane
- n-Hexane
- n-Octane
- n-Decane
- 2-Heptanone
- Toluole
- Acetone
- Formaldehyde
- Erythroid Acetylcholinesterase
- Insectizides (d-phenotrin, permethrin and metabolites)

In the urine:

- 2,5-Hexandion (metabolite of n-hexan)
- o-Kresol (Metabolite of Toluol)
- Acetone
- Trikresyl-phosphate
- Triphenyl-phosphate
- Tributyl-phosphate

Whereas the above protocol has been reviewed by medical and other experts who are familiar with the various issues regarding cabin air contamination, this is to be seen as a starting point and is not intended to be all inclusive.

Additional possible tests to check for exposure:

Clothing:

Worn uniform shirts/blouses (also ties): do not wash, fold well and place it in an airtight

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packing. Pack samples separately. They can be tested for engine oil, hydraulic oil and glycol residues at various laboratories if necessary.

Hair:

Tricresyl-Phosphate and certain metabolites can be detected in hair samples. More info [here](#) or go direct to: [order](#)

Blood:

Determination of organophosphate exposure and injury to the nervous system by Professor M. Abou-Donia:

Auto Antibodies - available upon request, please contact us [here](#) (*Samples for the Auto Antibodies Test must be taken and stored in an even more specific way.*)

DNA Test - can help determine if you are a poor detoxifier, most laboratories offer this test. It can be helpful for personal knowledge, but at the moment is not a necessity.

Don't forget!

Documentation of details:

- Date & Time (if necessary with time zone)
- Type and extent of the fume event (smell? mist? fumes?)
- Complaints/ symptoms
- Record the time of sampling of urine, blood etc.
- Keep a copy of all documents in your own files

Some important INFO and tips

The half-life of most VOCs (volatile organic compounds) is typically a few hours; therefore, laboratory results reflect very recent exposures such as within hours or days. If you were exposed a month ago, even every day, you will most likely not see it.

Laboratory tests for VOCs are technically difficult to perform due to preparation and storage of test tubes. When some chemicals enter the body, they are partially broken down – or 'metabolized' – before they are excreted. Thus, when testing occurs, it is the 'metabolite' and not the chemical itself that can be detected, also the levels might be lower than they would have been initially! Various chemicals may have the same

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metabolite. Consequently, results of the testing may be misleading and must be analysed well.

It is impossible for us to give you names and locations of laboratories and [medical practitioners](#) in every country, please look for:

Not every laboratory can do these tests, as specific technology and training is needed. Please look for laboratories offering „**Biological Monitoring for Exposure to Volatile Organic Compounds**“ or „**Clinical Occupational Medicine**“ and „**Occupational Toxicology & Immunology**“, specialising in 'analytical laboratory for occupational toxicology and immunology'.

Example to look for in their services:

- Air and bio monitoring of volatile toxic substances, fumigants, solvents and metabolites in blood and urine
- Bio monitoring of isocyanate, metals, cotinine, pesticides

Samples sent to a laboratory must be delivered in an uninterrupted frozen condition (e.g. on lots of dry ice in a styrofoam box by courier).

Some helpful information to refer to if and when medical doctors wish to have more background:

- [Science](#)
- [Presentation](#)
- Suspected substances can be checked out via material safety data sheets (MSDS)

Older :

- IATA fumes medical guidance: view [Pdf](#)
- Previous OHRCA medical protocol (2009) view [Pdf](#)

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