International
Medical & Laboratory Protocol after Fume Events

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.

Therefore have blood and urine samples taken within 2 - 3 hours, at the very latest 48 hours, and remind the medical personnel that the connection is a '**poisoning' by inhalation of CO fumes and other neurotoxic gasses.**

Some tests **must be done** within those 2-3 hours, as those values tend to change very quickly - they can sink to 50% of the initial value within 4-5 hours. At the very least get the blood drawn and save several samples of blood and urine (*see below for more info*) and store them in the **deep-freeze at minus 20°C (-4 °F)**.

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

è***Warning****: smoking may impact the measurements, please advise the medical personnel when you had your last cigarette.*

Have all symptoms such as change of heart rhythm disorders, shortness of breath examined by specialized medical personal and documented. Reminder: Advise medical personnel that you may have been exposed to a 'poisoning' by inhalation of CO and other neurotoxic gasses related to aircraft fluids – engine oils, hydraulic or deicing fluids and the thermally degraded mixtures.

Details:

Disinfection 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.

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Note: Metabolic parameters such as cholesterol and sugar can be omitted.

Carbon monoxide-saturated hemoglobin for forensic purposes. **>** *Important*: This measurement must be taken 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.

AChE - *(= red blood cell acetyl cholinesterase 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. You might get it done anyway, just in case another event happens - then you do have a comparison!

How to draw and store blood and urine samples

Important: *Disinfection 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 5 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 (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 should be done straight after, or latest within 48 hours of exposure as the values deteriorate within a few 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)**.

Some long-term effects of neurotoxicity can be

- Fatigue
- Memory loss
- Concentration issues (brain fog)
- Word finding problems
- Vision issues
- Headaches (recurring)

- Muscle weakness
- Palpitations & breathing problems

Symptoms must be continuously documented and medically treated. A diary with copies of findings should be kept.

When long-term effects/symptoms persist test for (within +/-30 days):

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

When pneumatic tests become necessary due ongoing respiratory issues:

- Spiro Ergo
- Lung Ventilation
- Perfusion and -Diffusion (TLCO and TLNO).

The following tests could become necessary and can be repeated when ongoing symptoms persist:

- Blood gas analysis/earlobe blood gas analysis
- including CO- Hb and/or:
- Oxygen saturation
- Often also testing capillary obstruction after hyperemia is advisable
- Cardiac arrhythmia
- Shortness of breath (lung specialist!)
- Lung function (lung specialist!)
- ECG
- Cognitive testing

It is possible to have so called BIO-MONITORING done after fumes exposure. 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
- Toluene
- Acetone
- Formaldehyde
- Erythroid Acetyl cholinesterase
- Insecticides from the chemical family of pyrethroids (d-phenotrin, permethrin and metabolites)

In the urine:

- 2,5-Hexandion (metabolite of n-hexane)
- o-Cresol (Metabolite of Toluol)
- Acetone
- Tri-cresyl-phosphate (Organophosphates)
- Tri-phenyl-phosphate
- Tri-butyl-phosphate

This protocol has been reviewed by medical and other experts who are familiar with the various issues regarding cabin air contamination.

Clothing
Worn uniform shirts/blouses (also ties): do not wash, fold well and place it in an airtight packing. Pack samples separately. They can be tested for engine oil, hydraulic oil and glycol residues at various laboratories if necessary.

Additional possible tests:

Hair:

- Tricresyl-Phosphate and metabolites (TCP) here or go direct to: order

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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 n 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 is not a necessity.

Don't forget!

Documentation of details:

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

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 metabolite. Consequently, results of the testing may be misleading and must be analyzed 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**", specializing 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 isocyanine, 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