

## Information Sheet

# Odour Stack Emission Proficiency Test

### 1. Location

Hessisches Landesamt für Naturschutz, Umwelt und Geologie  
(*Hessian Agency for Nature Conservation, Environment and Geology*)  
Dezernat I3 – Luftreinhaltung: Emissionen  
(*Department I3 – Air Pollution Control: Emission*)

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**Please note:** The sampling takes place on the 1<sup>st</sup> and 3<sup>rd</sup> floor. A lift is not available

### 2. Contact

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### 3. Participants

This stack emission proficiency test was designed for laboratories authorised to perform measurements in accordance with §29b BImSchG (Federal Immission Control Act), as well as applicants for authorisation in accordance with BImSchG. Nevertheless, other laboratories, manufacturers of equipment, industrial departments engaged in emission monitoring etc. are welcome to participate, too.

**Please note:** Due to the limited space around the flue duct, without prior affirmation by the organiser for each laboratory only two people can participate in the sampling on site.

The total number of participating laboratories is limited to 10.

### 4. Task

The proficiency test programme simulates installations with predominantly constant operating conditions with regard to the emitted odour concentrations, at which at least three individual measurements are required according to “TA Luft” (Technical Instructions on Air Quality Control). One of the four odours used in this PT is *n*-butanol. For each of the 4 components 3 samplings are performed, summing up to 12 samplings in total. Each of these samplings has a duration of 10 minutes.

## 5. Carrying out the measurements

### 5.1 Measuring rooms and measuring cross-sections

The measuring rooms are located on the 1st and 3rd floors of the HLNUG building (rooms 130 and 371). All sampling ports there have an inlet section (vertical, straight inflow conduit) of at least 6.5 metres. Sampling ports of the following size (according to [DIN] ISO 228) and number are available for the proficiency test:

**Table 1:** Available sampling ports.

floor	3" internal thread (G3)	2" internal thread (G2)
1 <sup>st</sup> floor	8	4
3 <sup>rd</sup> floor	6	7

The assignment of the measuring rooms and sampling ports is determined by the HLNUG staff on site. Each participant is allocated at least one 3" sampling port (G3). The remaining ports are allocated by HLNUG on request. The sampling probes used by the participants must be matched to the inner diameter of the system of 40 cm.

### 5.2 Measurement of gas flow conditions

The ESA is operated in fresh air mode with preheating and, if necessary, humidification of the outside air. The system parameters are - as far as possible - kept constant during a measuring day. The gas flow conditions are selected so that droplet formation in the stack is prevented. During the proficiency test, the following parameters of gas flow conditions shall be measured, conforming to [DIN] EN 15259:

**Table 2:** Value ranges for gas flow conditions and specified rounding of the measured values.

No. (k)	component	value range
R1	volume flow	2000 – 6000 m <sup>3</sup> /h (sc, dry)
R2	mean flow velocity	4 – 15 m/s (oc, wet)
R3	temperature	20 – 50 °C
R4	water vapour concentration	0 – 50 g/m <sup>3</sup> (sc, dry)
R5	static pressure	0 – 10 hPa

sc, dry: standard conditions, dry; oc, wet: operating conditions, wet

When measuring the gas flow conditions, the participants must apply the measurement methods they normally use on comparable installations.

### 5.3 Carrying out the samplings

- Each participant carries out the determination of the odour concentrations in accordance with [DIN] EN 15259 and the standards and guidelines listed in Table 3 in their current version. For the application of other sampling or analysis methods in the case of participations in connection with the 41st BImSchV, a proof of equivalence according to [DIN] EN 14793 must be provided.

- Sampling takes place simultaneously for all participants. The following components are determined using the following measurement procedures:

**Table 3:** Measuring methods and concentration ranges for gaseous components.

No. (k)	component	compulsory method	concentration range	criterion for proficiency assessment $\sigma_k$
01	n-butanol	[DIN] EN 13725, VDI 3880	50 to 50,000 ouE/m³	0.10
02	varying substances or mixtures			
03				
04				

- The methods used by the participant in the proficiency test must correspond as far as possible to the standard methods routinely used at comparable real plants. For organisational reasons, only the following deviations are permissive:
  - Reduction of the sampling time from 30 to 10 minutes
  - Olfactometry in an odour room near the sampling site, which the participant does not use routinely.
- The participants in the proficiency test must perform the sampling and the olfactometry with their own measuring equipment.
- Transport of samples and olfactometry are organised by the participants.
- The sampling equipment must allow for measurements in flue gases with a high water vapour content.
- For each component 3 consecutive measurements are carried out at equal concentrations. Each sampling has a duration of 10 minutes.
- The odour concentrations are planned to range from 50 ou<sub>E</sub>/m<sup>3</sup> to 50,000 ou<sub>E</sub>/m<sup>3</sup>. For some components, the odour threshold is determined after the test, based on the measurement results of the proficiency test participants. For these compounds, the assigned value may be outside the above-mentioned limits.
- Sampling protocols, response matrices and other relevant documentation of the olfactometry in the proficiency test must be handed over to HLNUG by the end of the measurement day (until 19:00 o'clock at the latest), preferably in digital form. Submission of this data is possible via e-mail (pt@hlnug.hessen.de) or alternatively by USB-stick. Documents on paper can be copied on request.

## 5.4 Odour room

Olfactometry is generally carried out on site in Kassel. This can be done using a mobile olfactometry room (measurement vehicle) or another suitable room (e.g. seminar room in a hotel). If a participant requires a room provided by HLNUG, this must be stated in the registration for the proficiency test. The allocation of available rooms is done by HLNUG. Please contact HLNUG if you wish to inspect a room before the proficiency test.

In either case, it is the participant's responsibility to ensure that the room used for the olfactometry conforms to the respective standards.

Participants that do not work conforming to guideline VDI 3880 and therefore do not need to complete the olfactometry within 6 hours after sampling may also transport the samples to their own laboratory and perform the olfactometry within 30 hours conforming to EN 13725. As this deviates significantly from the procedure followed by other participants, this has consequences for the evaluation of results (see below).

## 6. Submission of results

All measurement results must be given as integers in  $\text{ou}_\text{E}/\text{m}^3$ , and relating to olfactometric normal conditions, wet ( $p=1013,25 \text{ mbar}$ ,  $T=293,15 \text{ K}$ ).

The measurement results must be submitted to HLNUG no later than **one week** after the sampling day by e-mail to the following address:

[pt@hlnug.hessen.de](mailto:pt@hlnug.hessen.de)

For this purpose, the measured values shall be entered in an Excel file, which can be downloaded from the HLNUG website at

<https://pt.hlnug.de>

Unless HLNUG is responsible for the late receipt, results submitted after more than one week will not be taken into account. In this case, the proficiency test is assessed as "failed".

Each participant can only submit one result per measurement and component. The measured values submitted by the participants are checked for plausibility by the HLNUG using the data collected during the proficiency test. If this plausibility check reveals doubts about the determination of measured values in conformity with the respective standards, the participant concerned will be asked to provide a detailed explanation of the determination of results. If a participant is not able, upon request, to reconcile the submitted measurement results in a comprehensible and standard-compliant manner with the raw data and other records produced within the framework of the proficiency test, the components concerned will be assessed as "not evaluated", in deviation from section 8. In this case, a corresponding note will be added to the communication of results. An exchange of results among participants before the deadline for submission of the measurement results or other collusive behaviour is not permitted. In the event of a violation of this regulation, all affected components will also be assessed as "not evaluated" and a corresponding note will be added to the communication of results.

Communication of the result evaluation to the participants in the proficiency test is made in the form of an overall summary no later than 6 weeks after expiry of the deadline for submission of the participants' measurement results.

Participation in the proficiency test is possible for laboratories that do not complete the olfactometry within 6 hours after the sampling. Please note, however, that regardless of the results for the four components, the evaluation report will include a statement that the participation is "failed" regarding 41. BImSchV. If the olfactometry of the samples taken on the ESA in Kassel was not carried out within 6 hours conforming to VDI 3880, the participation deviates significantly from the specifications for odour emission proficiency tests that were

acclaimed by the Conference of Ministers for Environment (UMK) and the Federation/Federal States Working Group on Immission Protection (LAI). As a consequence, a participation under these circumstances does not fulfil the requirements set by §16 IV No. 7a of the 41st Federal Immission Control Ordinance (41. BImSchV) and can, for example, not be used as a proof of competence for emission measurements in Germany in accordance with §29b Federal Immission Control Act (BImSchG).

## 7. Assessment of single measurement results

The evaluation of the proficiency test is carried out on the basis of the z-score procedure, using logarithmised values.

For the measurement value  $x_{ik}$ , which is for sampling number  $i$  of component number  $k$ , a z-score value  $z_{ik}$  is determined:

$$z_{ik} = \frac{1}{\sigma_k} \log_{10} \left( \frac{x_{ik}}{X_{ik}} \right)$$

In this equation,  $X_{ik}$  is the assigned value of the measurement, and  $\sigma_k$  is the precision criterion (criterion for proficiency assessment) for component  $k$ .

The assigned value is calculated from the mass concentration  $c_{ik}$  and the odour threshold  $c_{0,k}$  of the component:

$$X_{ik} = \frac{c_{ik}}{c_{0,k}} \text{ou}_E/\text{m}^3$$

The dosed mass concentration  $c_{ik}$  is determined for each measurement based on the measurement data of the dosing device and the volume flow. The odour threshold  $c_{0,k}$  of *n*-butanol is  $c_0 = 123 \mu\text{g}/\text{m}^3$ . The thresholds of all other components are deduced from proficiency test results according to the following procedure:

- a) A consensus value is calculated from the measurement results reported by at least 20 participants in at least two different proficiency tests previously run by HLNUG. Here, solely results of participants are taken into account, who participated regularly (olfactometry conforming to VDI 3880) and achieved the result “passed” for the component *n*-butanol in the respective proficiency test. The consensus value is obtained by the robust mean of the logarithmic values according to standard [DIN] ISO 13528 (algorithm A, annex C) and is updated on a regular basis by including new results. This calculation is restricted to measurements of the past five years as long as the above mentioned requirements are met.
- b) If not enough measurement results of former proficiency tests are available to determine the consensus value of a component by means of the procedure described under a), an alternative method is used: Here, the consensus value of a component offered during a proficiency test is subsequently calculated from the participants’ measurement results. Provided that the sampling was carried out within 14 days, results of several proficiency tests are taken into account. Solely results of participants are considered, who participated regularly (olfactometry conforming to VDI 3880) and achieved the result “passed” for the component *n*-butanol in the respective proficiency

test. The consensus value is obtained by the robust mean of the logarithmic values according to standard [DIN] ISO 13528 (algorithm A, annex C). If less than nine measurement results for one particular component are available that fulfil the above mentioned criteria, neither a z-score-based evaluation nor a performance rating are possible.

The precision criterion for all components is generally:

$$\sigma_k = 0.10$$

This criterion needs to be adjusted in compliance with [DIN] ISO 13528, when the following condition is not met:

$$\sigma_k \geq \frac{1}{0.3} \log_{10}(1 + u_k)$$

with  $u_k$  as the relative uncertainty of the assigned value per component calculated in accordance with [DIN] ISO 13528. In doing so,  $\sigma_k$  is recalculated precisely to two decimal places, so that the condition is fulfilled. Participants are informed about the increase of the precision criterion at the latest when the evaluation is communicated by HLNUG.

The z-scores can be interpreted the following way:

$ z_{ik}  \leq 2$	satisfactory performance (no signal)
$2 <  z_{ik}  < 3$	questionable performance (warning signal)
$ z_{ik}  \geq 3$	unsatisfactory performance (action signal)

Generally, for each measurement resulting in a z-score of more than two, a causal research should be conducted.

## 8. Evaluation of components

For the evaluation of a component, the mean value  $z_k$  of the absolute values of the  $n$  z-scores (usually  $n = 3$ ) of each component is calculated:

$$z_k = \frac{1}{n} \sum_{i=1}^n |z_{ik}|$$

A component was determined successfully, if

$$z_k < 3$$

is fulfilled. In this case, the component is rated “passed”. If this criterion is not met or if no measurement result was submitted in due time, the component is rated “failed”. With a precision criterion of  $\sigma_k = 0.10$ , the above-mentioned criterion is not satisfied if the mean measurement value of a participant is lower than half of (50%) or higher than twice (200%) the assigned value.

## 9. Overall evaluation of the proficiency test

The overall result of the proficiency test is “passed”, if all components 01-04 were determined successfully. If one or more components 01-04 are rated “failed”, the overall result is “failed”. If the participant did not participate in at least one of the components 01-04 or could not be assessed for one of these components for other reasons, while the other components were assessed as “passed”, the participant receives the overall assessment “failed (incomplete participation)” for the participation in the proficiency test.

Where applicable, reference is made to the significance of this assessment in relation to section §16 IV 7a of the 41<sup>st</sup> BImSchV.

## 10. Communication of the evaluation

Communication of the evaluation of the participants’ results by HLNUG will be done within six weeks after the day the proficiency test took place and is given to the participants in form of a general survey. Furthermore, HLNUG regularly issues an annual report comprising the measurement results of all participants in the proficiency tests per year in an anonymised form.

Attention is drawn to the obligation of the notified measuring bodies to inform the respective notification authority directly of the results of the proficiency test (section 16 IV 7 of the 41<sup>st</sup> BImSchV).

## 11. Appeals and complains

Appeals and complaints should be addressed to the organizer of the proficiency testing scheme, if they relate to the invitation, the conduct of the proficiency testing scheme, the communication of results, or the results themselves. Various aspects of the proficiency test programme may be subcontracted at times. In case of subcontracting, this is done to a competent subcontractor, for whose work the HLNUG is responsible.

Appeals and complaints should be addressed to the authority responsible for authorisation under national law, insofar as they relate to measures derived from the results (e.g. a request to repeat the proficiency test, withdrawal of the authorisation, etc.).

The time limits for appeals are regulated in the respective notices and notifications.

## 12. Costs

The participation fee is levied in accordance with the regulations for administrative costs of the Hessian Ministry of Environment, Climate Protection, Agriculture, and Consumer Protection (Hessisches Ministerium für Umwelt, Klimaschutz, Landwirtschaft und Verbraucherschutz, VwKostO-MUKLV, for the full text see: [www.rv.hessenrecht.hessen.de](http://www.rv.hessenrecht.hessen.de)) in the current version. Upon confirmation of your participation, you will receive a notification of prepayment, payable before the start of the proficiency test. If a short-term cancellation of the proficiency test by HLNUG should be necessary for important reasons (e.g. facilities or personnel shortage, etc.), the prospective proficiency test participant has no claim to compensation except reimbursement of the participation fee.



### **13. Timetable**

On the following page you can find the timetable for the proficiency test. A prerequisite for the observance of the specified times is, among other things, the smooth and swift performance of the measurements by the participants. The organisers cannot therefore guarantee that the times will be adhered to. Depending on the actual course of the performance of the individual items, there may be delays in the schedule. In the event of deliberate disruptions to the schedule by individual participants, they may be excluded from the proficiency test.



## **Timetable Odour Proficiency Test**

### **Day 1**

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- from 13:00** Arrival of participants and set-up of sampling equipment, allocation of odour rooms (where applicable)
- 15:00** Welcome and introduction (**room 258**, not mandatory)
- until 17:00** Completion of preparations in the measuring rooms and HLNUG odour rooms

### **Day 2**

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- 08:00** Measurement of gas flow conditions part I (pressure, temperature, humidity)  
*(This part of the gas flow conditions is measured by all participants at the same time)*
- 08:30** 12 samplings in accordance with EN 13725
- 12:30** Lunch break
- 13:00** Measurement of gas flow conditions part II (volume flow profile)  
*(This part of the gas flow conditions is measured by one participant after another.)*
- until 16:00** removal of measuring devices at the ESA
- until 19:00** Submission of raw data and protocols from the olfactometry (for all participants), removal of measuring devices from HLNUG odour rooms.