

TEST AND EVALUATION



Biological sensors/samplers are used to detect the presence of biological agents in the field. These devices need to comply with operational and technical requirements.

TNO can assist manufacturers, end-users, buyers and other stake-holders in defining their specific requirements and validate the performance of detector systems against the specifications.

TNO support may consist of contract research and development, as well as providing laboratory testing, technical advice and consultancy on procurement issues. The laboratory test capabilities include a bioaerosol test chamber and laboratory testing up to Biological Safety Level 3.

Support

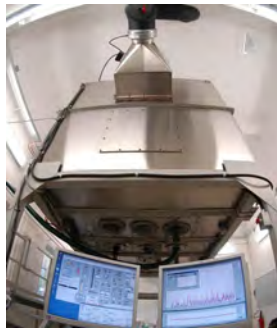
To our customers TNO offers support in the procurement and the development of sensors/samplers. TNO offers support in developing and improving your sensor for detecting the biological agent in anticipated scenarios. This includes in-house laboratory testing in a bioaerosol test chamber, which allows both dynamic and static exposure of sensors and samplers with biological agent at Biological Safety Level 1 (BSL 1) and non-aerosol tests with viable material up to Biological Safety Level 3 (BSL 3). In addition, TNO can provide consultancy during the biological sensor development. This

consultancy may vary from technical advice to support in the development of requirements a system should meet. These requirements can be based upon a requirement breakdown of a tailor made DIM (Detection, Identification and Monitoring) architecture supported by TNO.

Support can also be provided in procurement processes. Besides requirement development, this support may also exist of evaluation tests, evaluation of tests results and compliance analysis of quotations with the requirements.

Laboratory and operational testing

The compliance of the sensor/sampler with preset requirements can be experimentally verified. Besides the often determined Limit of Detection other operational parameters such as response time, sensitivity, false alarm rate can be determined. These parameters are often interdependent and provide the operator an idea about the applicability of the system in a relevant environment.

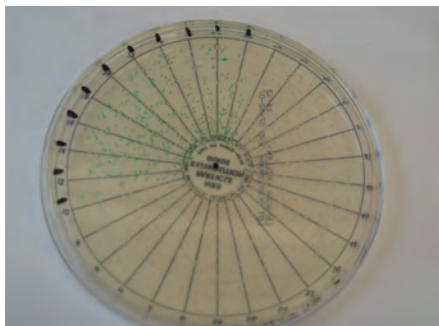


They are often graphically presented in a so-called Receiver Operator Characteristic (ROC) curve. If required the evaluation with BSL 1 organisms will be extended to BSL 3 organisms. These verifications will not be performed in the bioaerosol test facility but in our BSL 3 laboratory. In this case the verification procedure will be split into two parts, a sampling evaluation part with BSL 1 organisms and an identification evaluation part with non-aerosolized BSL 3 organisms.

BioAerosol Test (BAT)-chamber

TNO can test biological sensors using internationally accepted biological agent simulants or other BSL 1 agents in combination with several interferents in the controlled atmosphere of a Dycor® 12 m3 BAT-chamber.

In the BAT-chamber the aerosol challenge, the temperature and the humidity are controlled and registered during exposure experiments. This offers the possibility to reproduce the challenge. The aerosol challenge can be administered in a static or dynamic mode. The challenge can be generated from dry material and suspensions. Besides sensor/sampler testing this chamber also offers the possibility to study decontamination



effectiveness, aerosol deposition and agent fate.

Although the BAT-chamber is fully contained and inherently safe no pathogenic strains are used to generate aerosols. Instead, TNO utilizes internationally accepted biological agent simulants.

Among these simulants:

- Spores of *Bacillus atropheus* bacterium: for modeling spores of the Anthrax bacterium *Bacillus anthracis* (Concentration 5-100 ACPLA).
- *Erwinia herbicola* vegetative cells: for modeling Gram-negative bacteria, including *Yersinia pestis*, *Franciscella tularensis* and *Brucella* (Concentration 5-100 ACPLA).
- MS2 a known bacteriophage (Concentration 5-100 PFU).
- Ovalbumin: for modeling protein toxins, including ricin and botulinum toxin (Concentration 5-50µg).

Evaluation sensors

At present there is no international standard for the evaluation of bioaerosol sensors. The specifications are mostly established in close consultancy with future end users. Among the evaluation tests TNO can provide standard to the customer are:

- Tests with the four standard simulants
- Tests at low, medium and high concentrations
- Determination of response time
- Exposure times of 15 minutes per event to check whether the sensors goes out of alarm condition
- Multiple tests for each alarm condition to obtain the required confidence level
- Use of an interferent, e.g. soot, in combination with simulants
- Use of mixtures of simulants

Alternative evaluation tests can be designed upon customers request.

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TNO is an independent research organisation that connects people and knowledge to create innovations that boost the sustainable competitive strength of industry and well-being of society.

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