

Advanced Septic System Nitrogen Sensor Challenge, Phase II: Prototype Testing

Q: Will sensor developers be able to send their sensor packages to Battelle or EPA for installation ahead of the testing at MASSTC?

A: No. Sensor developers will be required to install and setup their own sensor packages at the Massachusetts Advanced Septic System Testing Center (MASSTC), the Barnstable, MA testing facility. EPA, Battelle and MASSTC will be establishing a specific date for the sensor setup period. Each team will be expected to deliver, install their sensor on the test vessel, and calibrate their device during the setup period. EPA and MASSTC staff will be on hand to assist with logistics during the setup period, but will not be responsible for device set up, calibration or repair. The testing will begin immediately following the Setup Period.

Q: Will sensor developers who did not participate in Phase I of the Advanced Septic System Nitrogen Sensor Challenge be eligible to participate in Phase II (the testing phase)?

A: Yes. Any sensor developer whose sensor package meets the logistical requirements outlined in Table A-2 of the Test/Quality Assurance Plan (T/QAP), completes an application, and whose application is accepted by EPA and Battelle will be eligible to participate in both of the one-month tests. The sensor developer participation in Phase I is not a requirement. Both the T/QAP and the application can be found on the VerifiGlobal website [VerifiGlobal website](#).

Q: What is the maximum allowed size of the sensor?

A: The overall dimensions of the sensor unit should be no larger than 6" x 6" x 20", with the submerged portion of the device being no larger than 6" x 6" x 6". This is a change from what was presented in the December 17, 2017 informational webinar and in the first version of the Test/Quality Assurance Plan (T/QAP). After careful consideration, EPA determined the need for more flexibility in the sensor dimensions.

Q: What are the performance goals for the sensors?

A: The overall performance goals for the sensors are presented in the Table below (Table A-1 of the T/QAP). After a high level quality assurance and statistical review of the T/QAP, an EPA statistician advised the EPA sensor challenge team to restate the accuracy, precision and range in the Performance Goals Table (Table A-1 in the T/QAP). The changes made reflect practical technology considerations for an in-situ device, the intended field application of the sensor in a septic system, and quality review of the test plan. The highlighted cells in the table below reflect the changes that have been made to Table A-1 of the initial T/QAP.

Attribute	Attribute Description	Performance Goals		
		Minimum	Almost Ideal	Ideal
Parameter¹	What is being measured	NO ₃ ⁻ , NH ₄ ⁺	NO ₃ ⁻ , NH ₄ ⁺ , TOC	Total nitrogen (TN) ²
Installation Price	Price to the homeowner to install	\$1,500	\$1,250	\$1,000
Data Management	Ability to record and transmit data (i.e., telemetry) for real-time access by practitioners, regulators, and interested stakeholders	Record and automatically transmit data to designated server or cloud	Record and automatically transmit data to designated server or cloud	Record and automatically transmit data to designated server or cloud
Applicability & Accessibility	Applicability of sensor(s) to various innovative/alternative system designs and ease of access to OWTS for installation and maintenance	Located in-situ to provide performance information on the OWTS; must be accessible for maintenance	Located in-situ to provide performance information on the OWTS; must be accessible for maintenance	Located in-situ to provide performance information on the OWTS; must be accessible for maintenance
Frequency of Sensor System Maintenance	How often the sensor(s) need to be maintained	No more than quarterly	No more than semi-annually	No more than annually
Accuracy	Accuracy of sensor measurements to the true measurement	Within 20% of true value ³	Within 20% of true value ³	Within 20% of true value ³
Precision	Repeatability of sensor measurements	≤30% RSD	≤20-30% RSD	≤20% RSD
Range⁴	Range of the detection	2-60 mg N/L	2-60 mg N/L 2-60 mg/L TOC	2-60 mg N/L
Sensor Operating Temperature Range	Temperature range in which the sensor can operate	4° C to 35° C	4° C to 35° C	4° C to 35° C
Deployment System Lifetime	Period of deployment Expected life of sensor	Continuous 5 years	Continuous 5 to 10 years	Continuous 10 years

¹ Refer to Section B1.4 for information on the sources of NO₃⁻, NH₄⁺, and TOC.

² Total Nitrogen (TN) is defined as the sum of total kjeldahl nitrogen (ammonia, organic and reduced nitrogen) and nitrate-nitrite.

³ True value is defined as the certified laboratory result for the parameter using approved test methods.

⁴ The sensors must be capable of alerting about or otherwise notifying of an over range value.

Accordingly, updates have also been made to the table below (Table A-3 of the T/QAP) to revise the subset of performance goals that need to be met for a sensor to advance to the field performance test. The highlighted cells in the table below reflect the changes that have been made to Table A-3 of the initial T/QAP.

Attribute	Performance Goals to Determine Field Performance Test Invitation
Parameter	Measures <ul style="list-style-type: none"> • NH_4^+ and NO_3^- <u>or</u> • NH_4^+, NO_3^-, and TOC <u>or</u> • TN
Data Management	Internal (local) sensor system data logger successfully collects time stamped data for the screen test
Applicability & Accessibility	Meets test size limits and performs under screen test environmental conditions
Maintenance	No more than one servicing during the preliminary screening test
Accuracy	Within 40% of true value
Precision	≤40% RSD
Range	2-60 mg N/L 2-60 mg/L TOC
Deployment	High frequency (at least hourly) measurement for the duration of the test