Advanced Septic System Nitrogen Sensor Challenge

Informational Webinar

Monday, July 16, 2018, 9:30 AM - 11:00 AM Eastern Time

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Agenda

- Goal of the Advanced Septic System Nitrogen Sensor Challenge
- Who's Who: Stakeholders and Technical Panel
- www.verifiglobal.com
  - Testing Application
  - Test/Quality Assurance Plan (T/QAP)
  - ISO Environmental Technology Verification (ETV)14034
- Purpose of the Test/Quality Assurance Plan (T/QAP)
- Overview of Testing Facility (MASSTC)
- Sensor Test Cell
- Requirements of Sensors
- Experimental Design and Performance Goals for Sensors
- Verification and ISO 14034
- Flowchart of Upcoming Activities and Timeline of Challenge
- Testing Application
- Questions and Comments

Goal of the Advanced Septic System Nitrogen Sensor Challenge

Identify, test, and verify the performance of <u>low-cost nitrogen sensor packages</u> which can measure and monitor the performance of advanced nitrogen removal septic systems

* From "SUFFOLK COUNTY'S RECLAIM OUR WATER INITIATIVE, USEPA WEBINAR, MARCH 21, 2018

Stakeholders’ Roles and Responsibilities

Organization	Role
EPA	Project Initiator
Battelle	Principal Contractor and Technical Verification Expert
VerifiGlobal	Subcontractor to Battelle and Independent Verification Body
Massachusetts Alternative Septic System Test Center (MASSTC)	Testing Organization
Barnstable County Dept. of Health and Environment (BCDHE) Laboratory	Analytical Laboratory
Sensor Developers	Testing and Verification Applicants
Technical Panel	Advisors
The Nature Conservancy	EPA Partner and Fundraiser for the Sensor Order

Technical Panel Members

Name	Affiliation	Expertise
George Heufelder	Massachusetts Alternative Septic System Test Center (MASSTC)	Advanced septic system testing and research
José Amador	University of Rhode Island (URI), Lab. of Soil Ecology and Microbiology	Soil science, microbial ecology, biogeochemistry, soil microbiology
George Loomis	URI, New England Onsite Wastewater Training Center	Septic system siting, design, O&M, and research
Brian Pellerin	U.S. Geological Survey	Water quality in-situ sensors and data collection platforms; soil science and runoff
Justin Jobin	Suffolk County Dept. of Health	Public Health Engineer, Regulator, Innovative and Alternative Onsite Wastewater Treatment Systems
Tom Wilson	Stony Brook University	Nutrient sensors, methods development, quality assurance, environmental applications
Hal Walker *	University of Massachusetts	Civil Engineering, with a focus on innovative onsite wastewater treatment systems
Mario Tamburri	University of Maryland Center for Environmental Science	Testing of sensor technologies
Christopher Clapp	The Nature Conservancy	Onsite wastewater treatment systems
Jim Bell	National Onsite Wastewater Recycling Association (NOWRA)	Process Engineer; wastewater treatment system design
Julius Enriquez	EPA	Analytical chemist; Environmental Technology Verification
Ian Dombroski	EPA	Water and wastewater treatment processes; aquatic chemistry
Brian Dudley	Massachusetts Dept. of Environmental Protection	Wastewater management

* In transition; need to confirm continued participation

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Glossary About Contact

VerifiGlobal Alliance | VerifiGlobal Solutions Network | VerifiGlobal Services | VerifiGlobal Benefits

19.06.18

New Testing Dates for the US EPA Advanced Septic System Nitrogen Sensor Challenge

Nitrogen sensor developers are invited to participate in 2 one-month tests offered in October 2018 and January 2019. Find out more here.

18.06.18

World Water Tech North America 2018

On October 24-25, 2018, join VerifiGlobal and water industry leaders at World Water-Tech North America in Toronto.

21.03.18

Battelle 2018 Conference on Remediation of Chlorinated and Recalcitrant Compounds

The Eleventh International Conference on Remediation of Chlorinated and Recalcitrant Compounds will be held April 8-12, 2018, at the Palm Springs Convention Center in Palm Springs, California.

VIEW ALL NEWS →

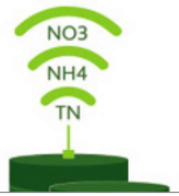
NEWSLETTER

Our June 2018 newsletter can be read here.

DOWNLOAD RECENT NEWSLETTERS →

ADVANCED SEPTIC SYSTEM NITROGEN SENSOR CHALLENGE, PHASE II: PROTOTYPE TESTING – FIND OUT MORE HERE

- → July 16, 2018 Informational Webinar – Registration Link
- → Challenge Background Information
- → Application for Performance Testing and Q&A
- → Test/Quality Assurance Plan (T/QAP)



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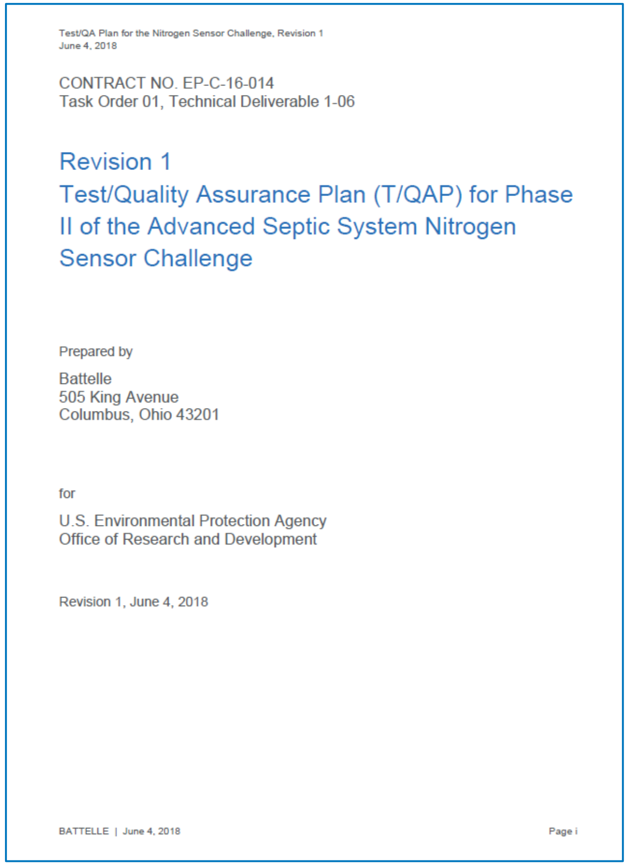
Purpose of the Test/Quality Assurance Plan (T/QAP)

- Documents the technology performance test procedure and quality assurance aspects of the project
- Outlines the procedures the project will use to ensure that samples, data, and subsequent reports are of high enough quality to meet project objectives
- Compliant with ISO 14034 Environmental Technology Verification (ETV) Standard
- Posted on VerifiGlobal Website



CONTRACT NO. EP-C-16-014
Task Order 01, Technical Deliverable 1-06

Revision 1
Test/Quality Assurance Plan (T/QAP) for Phase II of the Advanced Septic System Nitrogen Sensor Challenge

Prepared by

Battelle
505 King Avenue
Columbus, Ohio 43201

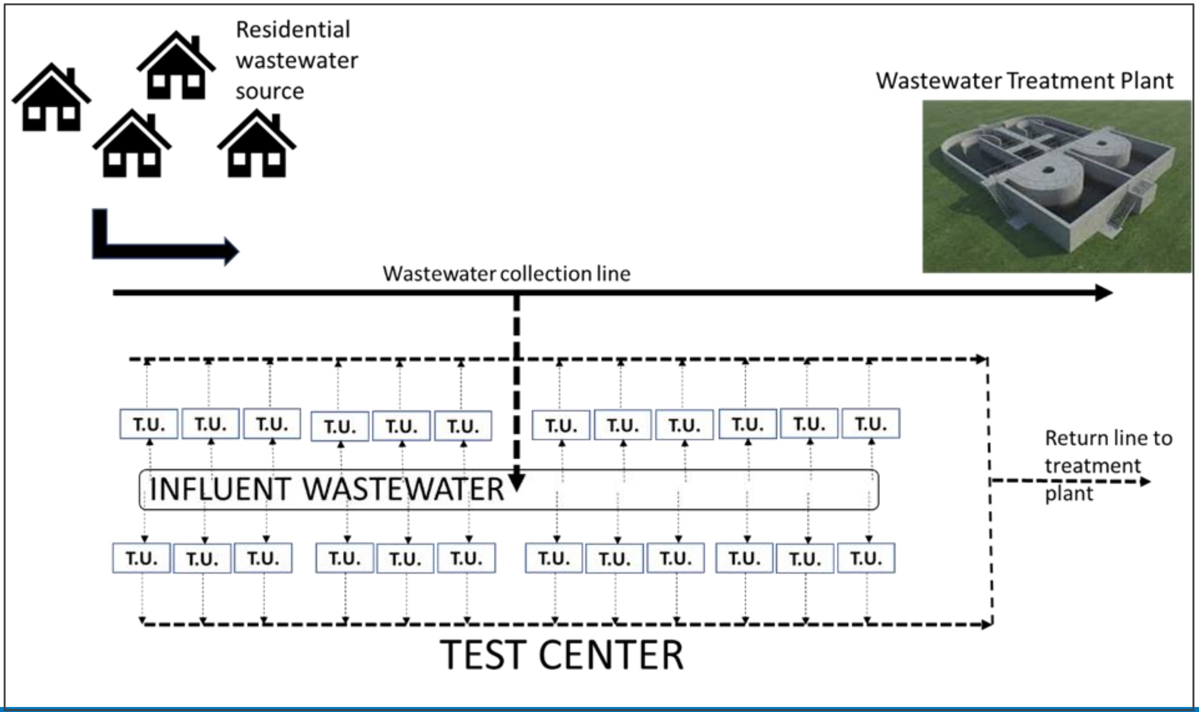
for

U.S. Environmental Protection Agency
Office of Research and Development

Revision 1, June 4, 2018

Overview of the Massachusetts Alternative Septic System Test Center (MASSTC)

- Provides third-party independent testing of advanced onsite treatment technologies and other devices
- Operating since 1999 by the Barnstable County Dept. of Health and Environment
- Located next to a wastewater treatment plant that serves military and jail facilities.
- One wastewater line is intercepted and the flow is divided into 21 testing locations.
- Runs in accordance with conditions required by NSF Standards 40 (Residential Onsite System) and 245 (Nitrogen Reduction)
- Samples taken daily to the Barnstable County Water Quality Laboratory



Sensor Test Cell

RAW WASTEWATER SOURCE

↓

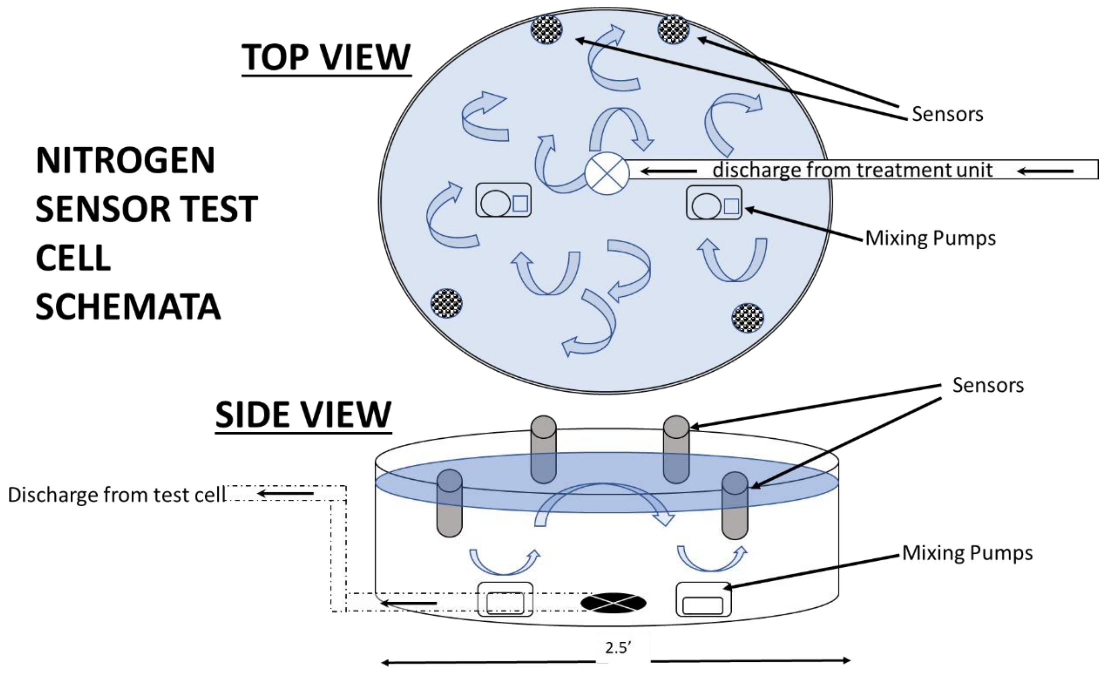
ONSITE WASTEWATER TREATMENT UNIT

↓

NUTRIENT SENSOR TEST CELL

↓

WASTEWATER RETURN LINE
(TO TREATMENT PLANT)



Test Cell Used in March 2018

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Requirements of Sensors

Table A-2. Logistical Requirements of the Sensors

Sensor Attribute	Requirement
Size of Sensor	Overall dimensions no larger than 6” x 6” x 20”, where the immersed portion of the device is no more than 6” x 6” x 6[1]
Attachment of Sensor to Test Cell	Attached to the side (side thickness: ~1/4”)
Power Supply	UL-listed direct current (DC) requiring no more than 3 amps at 120 volts
Data Output	Capable of collecting and retaining time stamped nitrogen test data for download
Interference	Sensors may not discharge into or in any other way contaminate the test cell contents[2]

[1] External electronics accompanying the sensor can be up to 12” x 12” x 12”.

[2] Incidental microscale contamination such as leaching from an antifouling coating or corrosion of a sacrificial anode will be permitted.

Experimental Design: Preliminary No-Risk Screening Test (1st week of 1-month study) – T/QAP Table B-1

Test Day	Day of Week	1st Test Date (2018)	2nd Test Date (2019)	Test	Phase	Test Fluid	Sample taken at hourly intervals	Total # of analyses (NH4, NO3, TOC, TN)
0	Mon-Tues	10/1 and 10/2	1/7 and 1/8	Vendor set-up and calibration	Off-line	None		
1	Wed	10/3	1/9	Accuracy/ Precision/ Range	Off-line	TW	1	4
					Off-line	TW + Low Std	3	12
					Off-line	TW + Med Std	3	12
					Off-line	TW + High Std	1	4
2	Thu	10/4	1/10	Accuracy/ Precision in matrix	On-line	TS	3	12
					Off-line	TS + Low Std	3	12
3	Fri	10/5	1/11	Alarm	On-line	PE	1	4
6	Mon	10/8	1/14	Accuracy following alarm	On-line	TS	1	4
7	Tues	10/9	1/15	Accuracy/ Precision/ drift at 7 days	Off-line	TW	1	4
					Off-line	TW + Low Std	3	12
					Off-line	TW + Med Std	3	12
					Off-line	TW + High Std	1	4
7 Day Total							24	96

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Experimental Design: Preliminary No-Risk Screening Test (Remainder of 1-Month Study) – T/QAP Table B-1

Test Day	Day of Week	1st Test Date (2018)	2nd Test Date (2019)	Test	Phase	Test Fluid	Sample taken at hourly intervals	Total # of analyses (NH4, NO3, TOC, TN)
8	Wed	10/10	1/16	Accuracy/ Precision/ Drift in matrix	On-line	TS	3	12
					Off-line	TS + Low Std	3	12
15	Wed	10/17	1/23	Accuracy/ Precision/ Drift in matrix	On-line	TS	3	12
					Off-line	TS + Low Std	3	12
22	Wed	10/24	1/30	Accuracy/ Precision/ Drift in matrix	On-line	TS	3	12
					Off-line	TS + Low Std	3	12
23	Thu	10/25	1/31	Power Failure (8-hours)	Off-line	TS		
24	Fri	10/26	2/1	Accuracy after power restoration	On-line	TS	1	4
29	Wed	10/31	2/6	Accuracy/ Precision/ Drift in matrix	On-line	TS	3	12
					On-line	TS + Low Std	3	12
30	Thu	11/1	2/7	Accuracy /Precision/ Linearity/ Range	Off-line	TW	1	4
					Off-line	TW + Low Std	3	12
					Off-line	TW + Med Std	3	12
					Off-line	TW + High Std	1	4
31	Fri	11/2	2/8	Demobilization				
1 Month Total							57	228

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Experimental Design: Test Procedures

- **Off-line:** flow-through septic fluid plumbing will be valved off
  - Alternatively introduced tap water, low standard, medium standard, and high standard test fluids
  - Test fluids: tap water spiked with low, medium, and high concentrations of:
    - Nitrate solution (KNO_3 preserved with chloroform): 1-15 mg N/L; 10-40 mg N/L; 30-60 mg N/L
    - Ammonia solution (NH_4Cl): 10-15 mg N/L; 10-40 mg N/L; 30-60 mg N/L
    - Organic nitrogen (C_5H_4NCOOH): 10-20 mg N/L; 15-40 mg N/L; 30-60 mg N/L
  - Matrix Spike of OWTS treated sewage effluent spiked with low standard

Experimental Design: Test Procedures (cont.)

- **On-line:** flow-through valves will be opened and used to deliver effluent to the cell
  - Tested using OWTS treated sewage effluent and primary treatment only effluent (to simulate OWTS failure)
- After fluids or effluents are added, sensor test cell is mixed for at least 1 hour and a time-stamped sample taken.

Experimental Design: Sampling Methods

- Samples will be collected using ISCO™ portable liquid samplers, which use a peristaltic pump
- Field measurements of pH, dissolved oxygen, and temperature will be performed on the test fluid immediately before a fluid change, 1 hour after a test fluid change and whenever a sample is taken
- Field parameters will be monitored using a YSI 556 Multi Probe Sensor or equivalent
- Samples will be collected on the hour
- Samples will be immediately transferred to laboratory in pre-preserved bottles appropriate for the analyses and stored refrigerated until delivered for analysis

Performance Goals for Moving to the Field Performance Test T/QAP Table A-3

Attribute	Performance Goals to Determine Field Performance Test Invitation
Parameter	Measures • 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

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Experimental Design: Field Performance Test (6 months; Month 3 of 6) – T/QAP Table B-2

Test Day	Day of Week/ Date (2019)	Test	Phase	Test Fluid	Sample taken at hourly intervals	Total # of analyses (NH4, NO3, TOC, TN)
1	Tues 7/16	Accuracy/ Precision/ Drift in matrix	On-line	TS3	3	12
			Off-line	TS3 + Low Std	3	12
2-14	7/17 – 7/29		On-line	TS3		
15	Tues 7/30	Accuracy/ Drift in matrix	On-line	TS3	1	4
16-28	7/31 – 8/12		On-line	TS3		
29	Tues 8/13	Accuracy/ Precision/ Drift in matrix	On-line	TS3	3	12
			On-line	TS3 + Low Std	3	12
30	Wed 8/14	Accuracy/ Precision/ Range	Off-line	TW	1	4
			Off-line	TW + Low Std	3	12
			Off-line	TW + Med Std	3	12
			Off-line	TW + High Std	1	4
31	Thur 8/15		On-line	Switch to TSX		
Month 3 Total					21	84

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Overall Performance Goals of Sensors

T/QAP Table A-1

Attribute	Attribute Description	Performance Goals		
		Minimum	Almost Ideal	Ideal
Parameter	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
Range[4]	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	Period of deployment	Continuous	Continuous	Continuous
System Lifetime	Expected life of sensor	5 years	5 to 10 years	10 years

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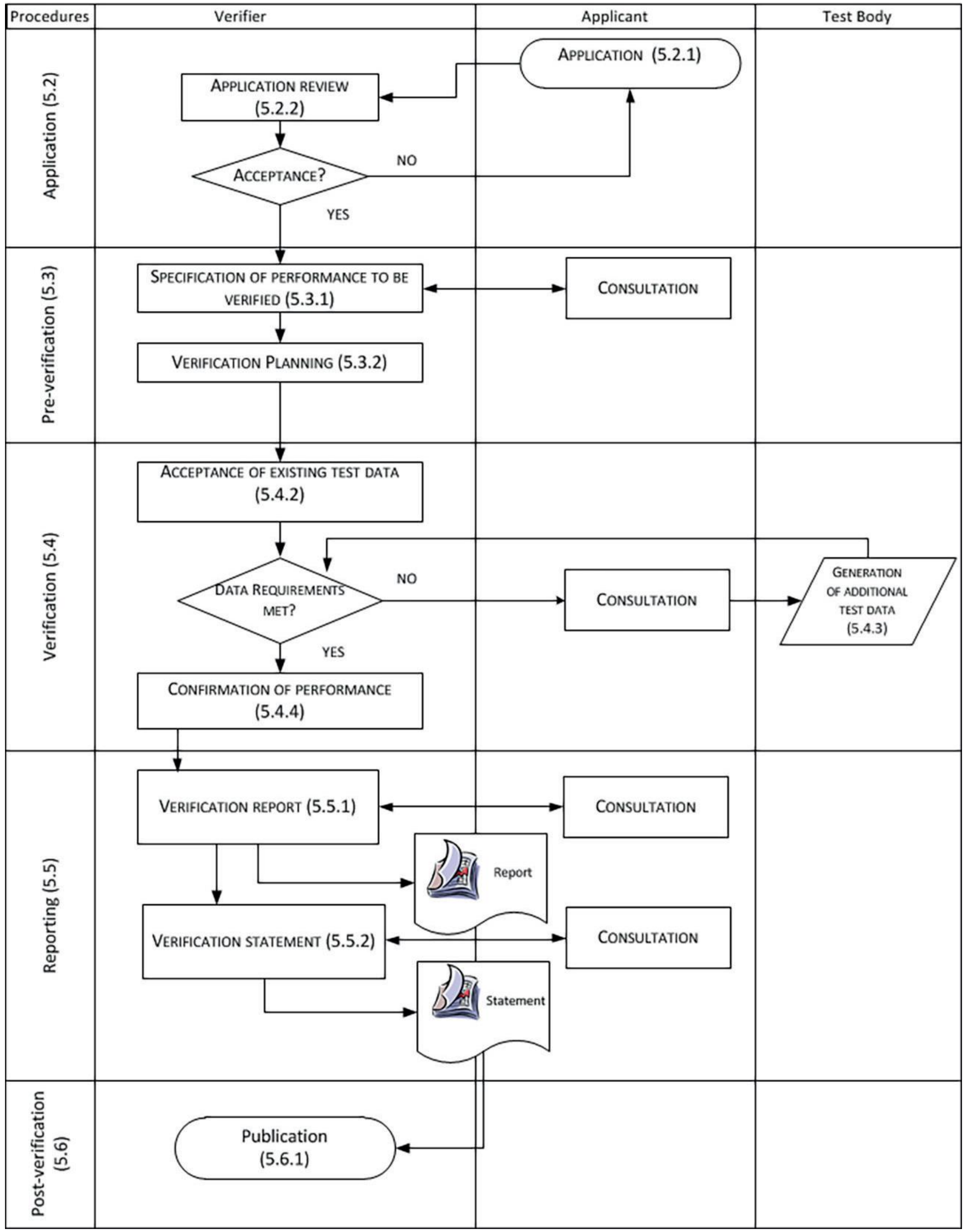
Verification and ISO 14034

- After the 6-month test, sensor developers will have the option to proceed with obtaining a Verification Report and Statement.
- Verification provides credible, reliable, and independent verification of a technology's performance.
    - Factual Approach
    - Transparency and Credibility
- ISO 14034: international consensus based on a structured procedure to verify performance
- Verification Plan:
    - Required by ISO 14034 ETV standard
    - Provides clarity and guidance on the verification process
    - Provides guidelines for reviewing and verifying the data and other information supporting a technology performance claim
    - Describes the verification process specific to the technology and the performance to be verified



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Flowchart of Upcoming Activities and Timeline of Challenge

August 31, 2018: Deadline to submit Testing Application to participate in October 1-Week and 1-Month No-Risk Testing

October 1- November 2, 2018: 1-Week and 1-Month No Risk Test at MASSTC

December 7, 2018: Deadline to submit Testing Application to participate in January 1-Week and 1-Month No-Risk Testing

January 7 – February 8, 2019: 1-Week and 1-Month No Risk Test at MASSTC

March 4, 2019: Battelle will notify sensor teams of acceptance for 6-month field test

May 13 – Nov 15, 2019 6-month field test

February 21, 2020 – ISO ETV 14034 VerifiGlobal verification reports and statements completed

Testing Application

Available on VerifiGlobal website

Application for Advanced Septic System Nitrogen Sensor Challenge Performance Testing

Contents

* Developers who previously submitted applications need to confirm by email that they are attending the 1-month No-Risk Test and there are no changes to their application by the Application Due Date

Download: http://www.verifiglobal.com/~/media/Files/Verifiglobal/Septic-Sensor-2018/Testing-Application-Revised_20180615.ashx?la=da

Questions and Comments?

Please Raise Hand for Your Phone Line to be Unmuted
or
Add your Question/Comment in the Q&A Box

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