OWTS : CONSISTENCY BETWEEN CERTIFICATION AND FIELD RESULT

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#1

Are OWTS performing in real conditions as they are supposed to and as per manufacturer’s claims?

#2

Is certification under controlled conditions enough to support those claims?

#3

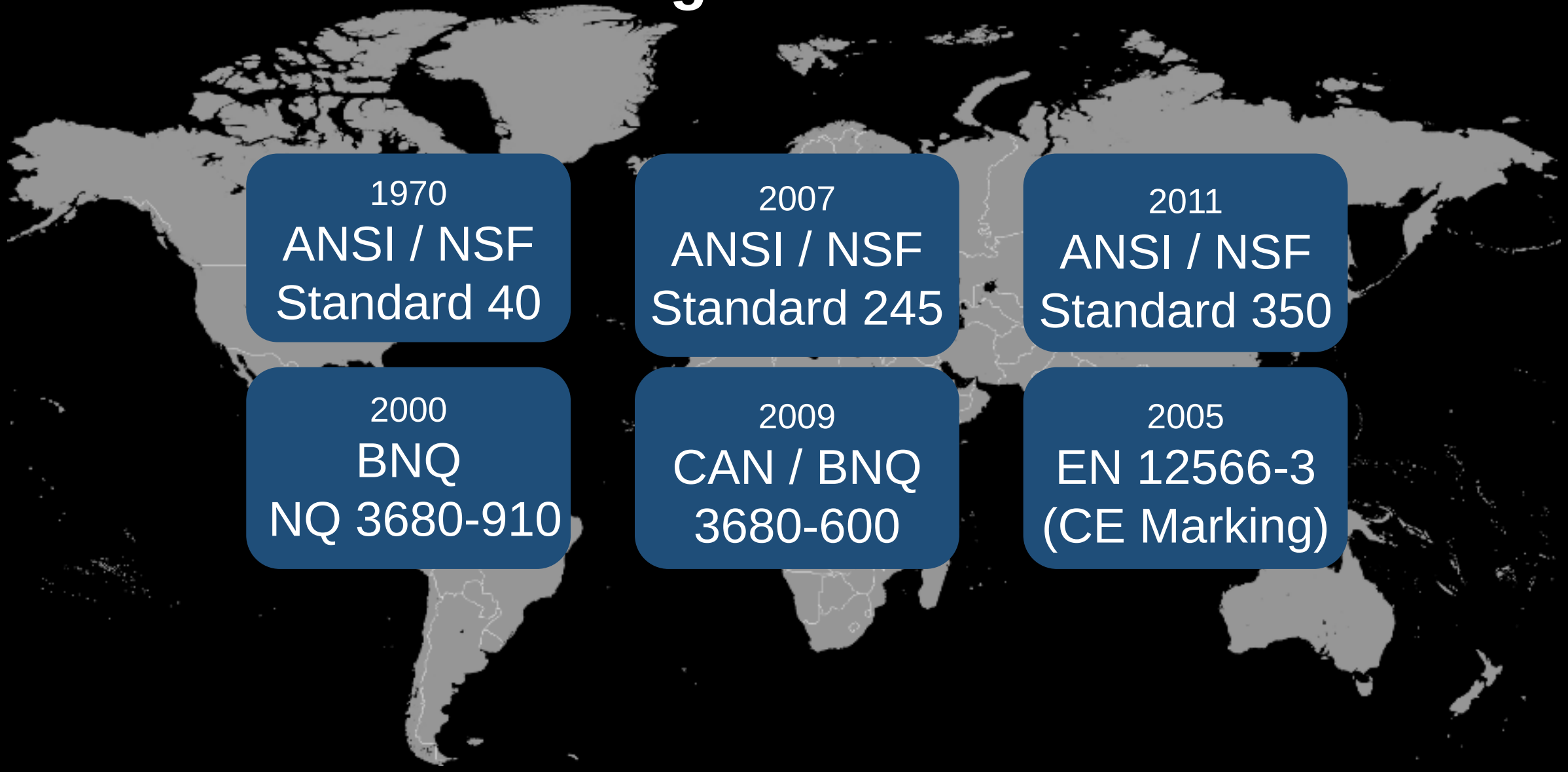
Should more extensive
field performance demonstration be required?

#4

What are the determining factors that will ensure consistency of results between certification and field results, and control and management over time of field performance?

Certification Programs

Main Certification Programs in the World



1970
ANSI / NSF
Standard 40

2007
ANSI / NSF
Standard 245

2011
ANSI / NSF
Standard 350

2000
BNQ
NQ 3680-910

2009
CAN / BNQ
3680-600

2005
EN 12566-3
(CE Marking)

Certification Standards in USA

NSF/ANSI 40

Base

BNQ NQ 3680-910

NSF 40 + additional 6 months (reliability) + climatic zones

CAN/BNQ 3680-600

BNQ + 2nd 6-month @working parents flow + sampling @stress test period

North American Certification Programs Comparison

Let’s look at the key differentiators of each program

Duration & Flow Regimen

	Duration	Flow Regimen
ANSI / NSF Standard 40 & 245	26 weeks	• 35% in the morning • 25% at noon • 40% in the evening (distributed over a 3h-period each)
BNQ NQ 3680-910	52 weeks	1st 26 weeks sequence: • 35% in the morning • 25% at noon • 40% in the evening 2nd 26 weeks sequence: • 40 % in the morning • 60% in the evening
CAN / BNQ 3680-600		

Stress tests

ANSI / NSF Standard 40 & 245

BNQ NQ 3680-910

CAN / BNQ 3680-600

Stress tests

- Laundry day: 3 days of laundry over 5 days
- Parents at work: 40% of Q in the morning and 60% in the evening
- Power/equipment failure: 48-hour stoppage
- Vacation: No water supply for 8 consecutive days

Sampling Frequency

	Sampling during stress tests
ANSI / NSF Standard 40 & 245	All: Sampling **only** the 1st day of stress test sequence and 24h after full completion of the stress test sequence for 6 consecutive days Power/equipment failure: 48h after completion of the stress test sequence for 5 consecutive days For standard 245: No sampling during all the stress tests for Nitrogen parameters
BNQ NQ 3680-910	All: **sampling during stress tests** for 5 consecutive days **Except** for Power/equipment failure: 24h after completion of the stress test for 5 consecutive days
CAN / BNQ 3680-600	

Audits & Temperature (climate)

	Field performance audit	Temperature
ANSI / NSF Standard 40 & 245	N / A	Can be tested in all climates
BNQ NQ 3680-910	10% of installs min. 5 & max. 10 annually	Tested in cold climate only Influent controlled at 64°F (18°C) or colder
CAN / BNQ 3680-600		Tested in cold climate only Influent controlled at 61°F (16°C±1) , 52°F (11°C ±1) or colder

Classification of performance

	Number of classes	BOD_5 (mg/L)	TSS (mg/L)	Fecals or E. Coli (CFU/100mL)	P Total (mg/L)	N Total (mg/L)
ANSI/NSF Standard 40	1	25	30			
ANSI/NSF Standard 245	1					50%
BNQ 3680-910	5	150 25 15 15 15	100 30 15 15 15	<50,000 <200 (<200)	<1	
CAN/BNQ 3680-600	4 (combinaisons)	BI: 150 BII: 25 BIII: 15 BIV: 10	100 30 15 10	DI: <50,000 DII: <200 DIII: N.D	PI: <1 PII: <0.3	NI: 50% NII: 75%
ANSI/NSF Standard 350 (Class R)	1	Avg: 10 Max: 25	10 30	<14 <240		

Regulatory Context & Field Testing

PROTOCOL

CRITERIA

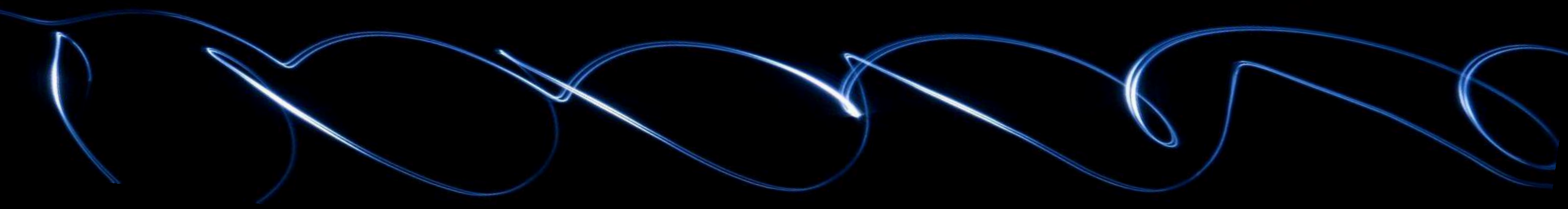
LOCAL REQUIREMENTS

PERFORMANCE EVALUATION

ACCEPTABLE CONCENTRATIONS

CONTROLLED CONDITIONS COMPLIANCE

REAL CONDITIONS



Certification Platform vs. field testing: What does it say?

Certification Platform		In-situ conditions
Nominal hydraulic loading	⟷	Hydraulic loading related to occupancy < nominal
Source of wastewater: community (possibly diluted)	⟷	Actual residential domestic wastewater (possibly not representative)
Established protocol (brand new system)	⟷	Impact of living habits & system aging

Materials and Methods

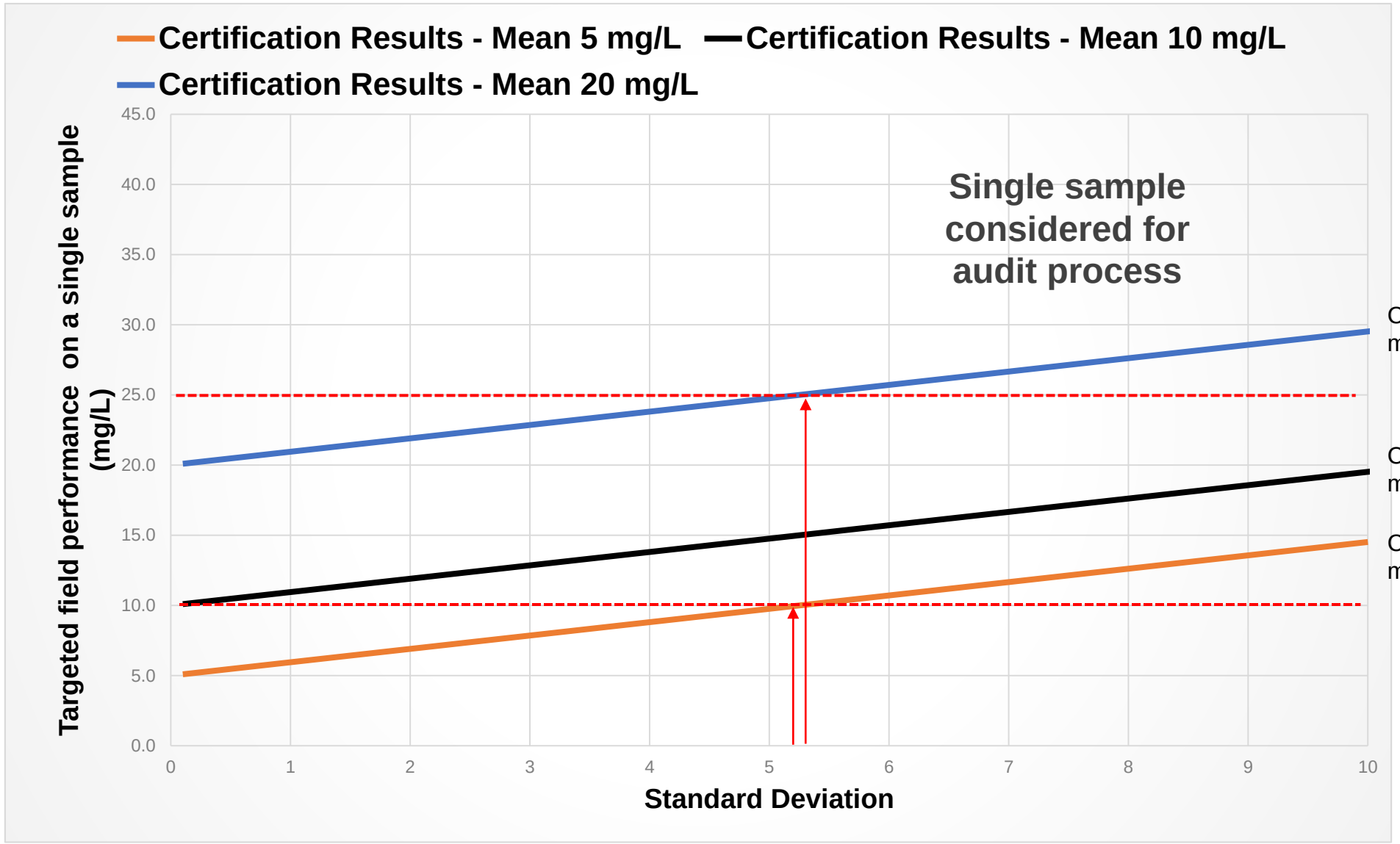
Methodology and data analysis

- Statistical analysis developed by EPA
- Goal = Determining Maximum Discharge Limit (MDL) in real conditions

Factors impacting MDL

1. Data distribution – Delta log normal
2. Number of data
3. Average performance and standard deviation
4. Tolerance (95%) and probability (80%)
5. Number of field sampling events considered = 1

Possible MDL Result Range



Certification Data Sets

CERTIFICATION PROTOCOL	DURATION	STRESS TEST RESULTS	AVERAGE INFLUENT TEMPERATURE	n
ANSI/NSF standard 40	The entire 6 months	Includes recovery period only	68°F (20°C)	114
CAN/BNQ 3680-600/2009 **No stress**	First 6 months only Annex A	Includes recovery period only	51°F (10.9°C) Cold climate conditions	106
CAN/BNQ 3680-600/2009 **Stress only**	Weeks 19 to 25 inclusively of Annex A	Stress tests and recovery period only	54°F (12.3°C) Cold climate conditions	27
CAN/BNQ 3680-600/2009 **Annex A**	The entire first 6 months Annex A	Includes stress tests and recovery period	52°F (11.2°C) Cold climate conditions	123

Third-Party Field Audit Data

Field monitoring program	Years	Number of samples (n)
BNQ annual field performance audit program	2006 to 2016	140
North Carolina innovative system performance audit	2006 to 2008	35

Results

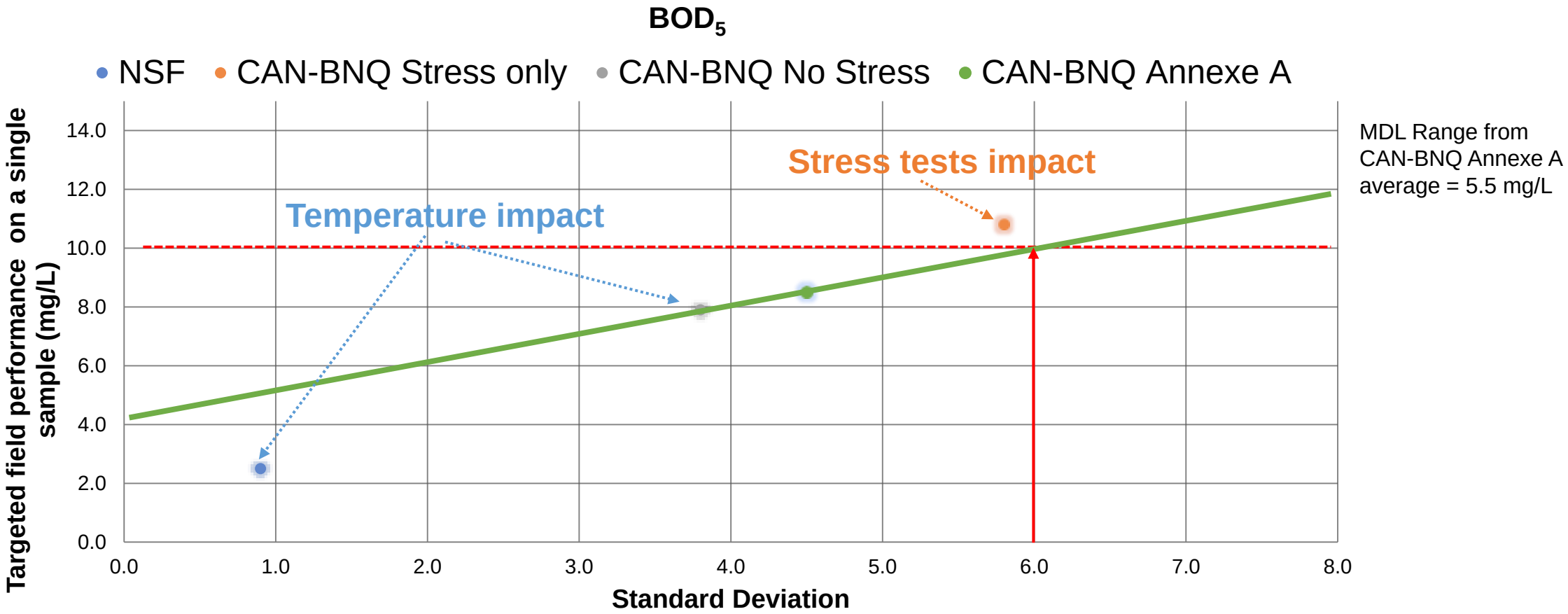
Calculation of MDL

With 95% certainty and 80% probability

Certification protocol			BOD_5 (mg/L)			TSS (mg/L)				Influent temperature °C
Data set	**n**	**$k_{95,80}$**	**Avg**	**StDev**	**MDL**	**$k_{95,80}$**	**Avg**	**StDev**	**MDL**	
NSF	114	0.95	2.1	0.9	**2.5**	0.95	2.4	1.9	**2.9**	68 F (20 C)
CAN-BNQ No Stress	106	0.50	5.0	3.8	**7.9**	0.80	4.3	3.7	**6.6**	51 F (10.9 C)
CAN-BNQ Stress only	27	1.01	6.6	5.8	**10.8**	1.08	5.1	4.4	**7.0**	54 F (12.3 C)
CAN-BNQ All Annex A	123	0.58	5.5	4.5	**8.5**	0.81	4.4	3.6	**6.7**	52 F (11.2 C)

Model prediction

Importance of selecting the right certification!



- For a same technology, the expected concentration in the field (MDL) varies according to the certification protocol
- The more stringent the certifcation protocol the more realistic are the predicted field values

MDL expected field performance vs. Third-Party field audit results

BOD_5	Calculated MDL (mg/L)*	% of field monitoring results in compliance with the calculated MDL	
		BNQ Audit	NC Audit
	Mean	3.8 ± 3.6	4.5 ± 9.3
	Number of data	140	35
ANSI/NSF standard 40	2.5	64%	69%
CAN/BNQ 3680-600 Annexe A	8.5	92%	86%
CAN/BNQ 3680-600 Annexe A Stress only	10.8	93%	90%

* Based on delta-log normal distribution with a certainty of 95% and a probability of 80% of not exceeding that value in the field for a single sampling

Conclusions

An important missing factor

- Certification and field demonstration programs are performed on newly installed systems only
- Systems aging is not considered, it is assumed to be "factored in"
- Annual random field performance audit allows the assessment of system performance from ALL ages
  - Performed annually on sites randomly selected among ALL systems installed

Answering #1

Are OWTS performing in real conditions as they are supposed to and as per manufacturer's claims?

Yes! BUT…

Reliable information from actual conditions (reality) are a must to all stakeholders, from authorities to end-users, for the protection of public health and the environment!

Answering #2

Is certification under controlled conditions enough to support those claims?

Representative certification programs, in-depth understanding of these protocols and their limits, and adapted classification of performance are key

Samplings requirements, influent temperature, flow regimen , etc key elements of certification protocols

Answering #3

Should more extensive field performance demonstration be required?

MDL is a good tool to evaluate expected field performance of the systems.

MDL is as good as the certification protocol that was submitted with the product…it has to be representative of the actual living habits of end-users, their local climate conditions and usage.

Field testing should be used as a complementary measure when no certification program exists.

Answering #4

What are the determining factors that will ensure consistency of results between certification and field results, and control and management over time of field performance?

Have certification protocols representative of your reality.
"Pick" the right one for you!

Stop spending $ and time in field monitoring.
Invest in annual random field performance audits.

All saved $ and time should be invested in promoting and enforcing systems design conformity and sound regular inspection and maintenance of these systems and their follow-ups.

THANK YOU!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