Comparisons of Methods for COVID-19 Virus (SARS-CoV-2), Human Coronaviruses, and Their Surrogates Environmental Surface and Air Testing, 2nd Ed.

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Category	Post-Cleaning Verification	Post-Disinfection Verifications			Virus Elimination Verifications & Surveys			
Analysis	ATP Test	Background Microorganisms Count	Traditional Biological Indicator (BI) Test	Novel Biological Indicator (BI) Test	Human Coronaviruses RNA Detection	COVID-19 Virus RNA Detection (Ph1)	COVID-19 Intact Virus Confirmation (Ph2)	COVID-19 Infectious Virus Confirmation (Ph3)
Analyte	ATP from live, dead, & decomposed cells	Viable bacteria/fungi	*Geobacillus* /*Bacillus* spores, standardized	*Saccharomyces cerevisiae* , standardized	RNA of COVID-19 & three common cold coronaviruses	RNA of SARS-CoV-2 (naked, damaged, intact, infectious, non-infectious)	RNA from envelope-intact SARS-CoV-2	Infectious SARS-CoV-2
Methodology	Bioluminescence Assay	Viable/Culture Method	Viable/Culture Method	Viable/Culture Method Tang Protocol [20-04A]	qRT-PCR [undifferentiating]	Phase 1: qRT-PCR	Phase 2: PMA-qRT-PCR ("Viability"-qRT-PCR)	Phase 3: Cell Culture Method
Cost	Very Low	Low	Low	Low to Medium	High	High	High	Very High
TAT	1 min	Bacteria: 10 hr to 3 days; Fungi: 1 to 7 days	4 hr to 3 days	8 hr to 3 days	1 to 5 days	1 to 5 days	1 to 5 days	Several weeks
Number of Samples Needed (per 100 ATP's)	100	30 for large (1.5"x1.5") sponges swabs	30	30	Depending on budget constraints	Depending on budget constraints	Depending on budget constraints	Depending on budget constraints
Sampling Surfaces	All building surfaces	All building surfaces	Strips, discs, dishes	Dishes	Frequently touched surfaces	Frequently touched surfaces	Frequently touched surfaces	Frequently touched surfaces
Sampling Devices	ATP swabs	Large sponge swabs	N/A	Small sponge swabs	High-Recovery single/triple flock-swabs	High-Recovery single/triple flock-swabs	High-Recovery single/triple flock-swabs	High-Recovery single/triple flock-swabs
Recommended Sampling Area Size	100 cm^2	144 -288 in^2	One device	One device	16 - 48 in^2	16 - 48 in^2	16 - 48 in^2	16 - 48 in^2
Transport Media/Temp.	N/A	Neutralizing buffer/2-8°C	No medium/Room Temperature (R.T.)	Neutralizing buffer/2-8°C	VTM/2-8°C VirusPRESERVE/R.T.	VTM/2-8°C VirusPRESERVE/R.T.	VTM/2-8°C (or dry ice for higher sensitivity)	VTM/2-8°C (or dry ice for higher sensitivity)
Recommended Passing Criteria	See manufactures & industry guidelines	< 1 CFU/16in^2	Sanitization (99.9%), Disinfection (99.999%)	Sanitization (99.9%), Disinfection (99.999%)	< DL (DL = 50 - 100 copies/sample)	< DL (DL = 50 - 100 copies/sample)	< DL (DL = 50 - 100 copies/sample)	< DL (DL = 100 - 1,000 IFU/sample)
Baseline Available	Yes/No	No	Yes	Yes	No	No	No	No
Resistance of Analyte to Disinfectants	N/A	Similar to human coronaviruses	High (bacterial endospores)	Similar to human coronaviruses	High (RNA)	High (RNA)	Similar to human coronaviruses	Similar to human coronaviruses
Effective Chemicals	Cleaner or water (& microfiber clothes)	EPA registered disinfectants for fungi/bacteria	Bleach, SteraMist, VHP, EPA registered disinfectants for C. diff.	EPA Registered Disinfectants for fungi/yeast	Bleach (1:10, 1:20) for breaking down RNA	Bleach (1:10, 1:20) for breaking down RNA	EPA Registered Disinfectants for HCoV	EPA Registered Disinfectants for HCoV
Majority Applications	Food industry cleanness check	Surface cleanness check	Building/Device decon. Verification (VHP, SteraMist, bleach)	Building/Device decon. Verification (all disinfectants)	Verification of the cleanness of disinfected surfaces	Detection of all SARS-CoV-2 RNA in clinical and environmental samples	Confirmation of the presence of envelope-intact COVID-19 viruses	Contaminated surface transmission risk assessment
Potential Liability When Detected	No	No	N/A	N/A	Minimal	Yes	Increased	Much increased
Advantages	Cheap, quick results	Not expensive	Sanitization (99.9%), Disinfection (99.999%) verifications	Sanitization (99.9%), Disinfection (99.999%) verifications	Much reduced liabilities & public scare, More proactive in measuring disinfecting success	Well publicized technology from clinical testing	Avoid the detection of "naked" RNA and envelope-damaged virus RNA	Detecting infectious (aka "live") COVID-19 viruses
Disadvantages	No disinfection verification	Only limited sanitization verification	Limited disinfectant selections	Limited service provider, need to prepare BI plates prior to testing	Limited service provider	Potential liability & unnecessary public scare	Limited service provider, Some "envelope-intact" viruses can be non-infectious (aka "dead")	BSL-3 virology labs needed are all urgently working on vaccines and medicines right now

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Analyte	Matrix	Sample/Device	Analyte Type	Analysis	Code	TAT: Fee (VIP)	TAT: Fee (Regular)
COVID-19 Virus Related Environmental Testing							
Human Coronaviruses RNA	Surface	Flocked Swab Large area 16-48 in²	RNA of four human coronaviruses [UNDIFFERENTIATED]	AccuScience MultiSWAB CoronaFOUR℠: qRT-PCR for RNA of SARS-CoV-2 and three common cold coronaviruses (HCoV-229E, HCoV-OC43, and HCoV-NL63) CAUTION: Viral RNA from both live & dead (infectious and noninfectious) virus will be detected.	HCOV-Live+Dead	4-5 days: $170 3 days: $205 2 days: $255 24 hours: $295 [Call first]	NA
COVID-19 Virus (SARS-CoV-2) RNA For hospitals and nursing homes, please call us for research project quotes.	Surface (Single Swab: $5; MultiSWAB: $10; +$50 for Ultra-Sensitive Analysis) Air (+$50 for Ultra-Sensitive Analysis)	Flocked Swab Large area 16-48 in² PTFE, PC Filter Cassettes	Phase 1: COVID-19 Virus RNA	AccuScience MultiSWAB COVID-19 RNAScreen℠: qRT-PCR for SARS-CoV-2 RNA CAUTION: Viral RNA from both live & dead (infectious and noninfectious) virus will be detected.	COV-19-Live+Dead	4-5 days: $170 3 days: $205 2 days: $255 24 hours: $295 [Call first]	NA
			Phase 2: COVID-19 Intact Virus Confirmation	AccuScience COVID-19 IntactVIRUS℠: PMA-RT-qPCR ("Viability"-qRT-qPCR) for envelope-intact SARS-CoV-2 RNA CAUTION: "Envelope-intact" viruses can have both infectious and non-infectuious viruses (aka "live" and "dead").	COV-19-Intact	4-5 days: $210 3 days: $245 2 days: $295 24 hours: $335 [Call first]	NA
			Phase 3: COVID-19 Infectious Virus Confirmation	AccuScience COVID-19 LiveVIRUS℠: Cell culture method BSL-3 virology labs needed are all urgently working on vaccines and medicines right now.	COV-19-Infectious	Extremely limited availability. Call for details. [Call first]	NA
Environmental Fungi & Bacteria	Surface	SpongeSWAB (L) Sample area: 144 - 288 in²	Fungi and Bacteria , Culturable, (25°C)	AccuScience SaniASSURE: Background fungi and bacteria total viable count No log reduction data available. Detection limit: 1 CFU/16 in²	FBC-PDV-12	3-5 days: $48 2 days: $58 24 hours: $68 10 hr(B)/24 hr(F): $88 Weekend: $120 [Call first] Holiday: $200	NA
COVID-19 Surrogate - Novel Biological Indicators	Culture, Surrogate	BI Plate nBI-20-SK, self-prep. kit (for 20 plates & swabs), $100	Yeasts (Viable)	AccuScience nSurrogateDISH: Yeast *(Saccharomyces cerevisiae)* growth measurement Kill rate of 3 to 5-log reduction	nBI-PDV-19-S	2 days: $75 24 hours: $90 8 - 10 hours: $105 Weekend: $150 Holiday: $200 [Call first]	NA
COVID-19 Surrogate - Traditional Biological Indicators	Culture, Surrogate	BI Plate tBI-20-GP, $10	Bacterial endospores (Viable)	AccuScience tSurrogateDISH: Gram-positive bacilli spores (*Geobacillus stearothermophilus*) bacterial growth measurement Fail/Pass of a 5-log reduction For TOMI SteraMist, (vaporized) hydrogen peroxide, and bleach (1:20 to 1:50) only	tBI-PDV-19-G	2 days: $75 24 hours: $90 6 hours: $105 4 hours: $125 Weekend: $150 Holiday: $200 [Call first]	NA

Analyte	Matrix	Sample/Device	Analyte Type	Analysis	Code	TAT: Fee (VIP)	TAT: Fee (Regular)
Legionella Environmental Testing							
Legionella	Water Surface Air	Cooling Tower, Evaporative Condensers Detection Limit (DL) = 10 CFU/ml	*Legionella* , Culturable	[Premium] Culture Method – BCYE Selective Agar With Basic Serotyping	LC-12-DL10	12 Days: $95	NA
				[Premium] Culture Method – BCYE Selective Agar With Basic Serotyping *NEW: AccuScience LegiFAST*	LC-12-DL10-LFAST	6 days (Early Warning, 96%) and 12 day: $125	NA
		Potable Water, Industrial Working Fluids Detection Limit (DL) = 1 CFU/ml		[Premium] Culture Method – BCYE Selective Agar With Basic Serotyping	LC-12-DL1	12 Days: $95	NA
				[Premium] Culture Method – BCYE Selective Agar With Basic Serotyping *NEW: AccuScience LegiFAST*	LC-12-DL1-LFAST [Promotion]	6 days (Early Warning, 96%) and 12 day: ~~$125~~ $95	NA
		Humidifier, Misters, Hot Tubs, Spa, Decorative Fountain, Whirlpool Detection Limit (DL) = 0.1 CFU/ml		[Premium] Culture Method – BCYE Selective Agar With Basic Serotyping	LC-12-DL0.1	12 Days: $125	NA
				[Premium] Culture Method – BCYE Selective Agar With Basic Serotyping *NEW: AccuScience LegiFAST*	LC-12-DL0.1-LFAST	6 days (Early Warning, 96%) and 12 day: $155	NA
		[Outbreak Investigation] Water (1000 ml Bottle), Swabs Detection Limit (DL) = 0.02 CFU/ml		[Premium] Culture Method – BCYE Selective Agar With Detailed Serotyping	LC-12-DL0.02	12 Days: $155	NA
				[Premium] Culture Method – BCYE Selective Agar With Detailed Serotyping *NEW: AccuScience LegiFAST*	LC-12-DL0.02-LFAST	6 days (Early Warning, 96%) and 12 day: $185	NA
		Swabs DL= 100 CFU/swab		[Premium] Culture Method – BCYE Selective Agar With Basic Serotyping	LC-12-DL100	12 Days: $110	NA
		Air DL= 1 CFU/plate		[Premium] Culture Method – BCYE Selective Agar With Basic Serotyping	LC-11	12 Days: $110	NA
		[New York State] Water (250/1000 ml Bottle), Swabs		[Premium] Culture Method – BCYE Selective Agars With Detailed Serotyping (NY State Samples)	LC-22NYS	14 days: $135	NA

Analyte	Matrix	Sample/Device	Analyte Type	Analysis	Code	TAT: Fee (VIP)	TAT: Fee (Regular)
Fungi (Mold) Environmental Samples Testing							
Fungi (Mold)	Air	COMMON SPORE TRAP	Fungi, Total (Non-Viable + Viable) 100% (400x) counting for small loose spores: add additional 60% fee	[Premium] Level 3 High Performance Spore Count™	FD-01HP	Std (3-5 days): $35 2 days: $38 24 hours: $45 6 hours: $60 3 hours: $95 Weekend: $120 Holiday: $200	Std (3-5 days): $65 2 days: $67 24 hours: $80 6 hours: $100 3 hours: $135 Weekend: $160 Holiday: $250
				[Premium] Level 3 High Performance Spore Count™ Triplicate Analysis With Precision Measurement - One Allergenco-D or Air-O-Cell Cassette (Intra-sample)	FD-01HP-PM	Std (3-5 days): $50 2 days: $55 24 hours: $65 6 hours: $90 3 hours: $135 Weekend: $160	NA
				- Three Allergenco-D or Air-O-Cell Cassettes (Inter-samples)	FD-01HP-PM3	3x FD-01HP Fee	NA
				- Three Micro5 Cassettes (Inter-samples)	FD-01HP-PMM5	2x FD-01HP Fee	NA
				[Advanced] Level 2 Advanced Spore Count	FD-01A	Std (3-5 days): $35 2 days: $38 24 hours: $45 6 hours: $60 3 hours: $95 Weekend: $120 Holiday: $200	NA
				[Basic] Level 1 Spore Count	N/A	N/A	N/A

Analyte	Matrix	Sample/Device	Analyte Type	Analysis	Code	TAT: Fee (VIP)	TAT: Fee (Regular)
Fungi (Mold)	Air	PurePLATE Individually Sealed Agar Plate	Fungi, Culturable, (25°C)	[Premium] Culture Method – 1 Agar Plate of MEA or DG18, Including Common Aspergillus Species ID	FC-11	7 - 9 days: $30	7 - 9 days: $45
				[Premium] Culture Method – 2 Agar Plate2 of MEA and DG18, Including Common Aspergillus Species ID	FC-11-MEA/DG18	7 - 9 days: $50	NA
				[Premium] Culture Method – 1 Agar Plate of MEA, Including Common Aspergillus Species ID *NEW: AccuScience FungiFAST*	FC-11-FFAST	5 days (Prelim.) and 7-9 days (Final): $47	NA
				[Premium] Culture Method – 2 Agar Plate2 of MEA and DG18, Including Common Aspergillus Species ID *NEW: AccuScience FungiFAST*	FC-11-MEA/DG18-FFAST	5 days (Prelim.) and 7-9 days (Final): $65	NA
			Fungi, Culturable (35°C)	[Premium] Culture Method – 2 to 4 Agar Plates: MEA and Mycologix MEA, Including Common Aspergillus Species ID	FC-11-35	7 - 9 days: $37	NA
			Common Aspergillosis Airborne Agents: Aspergillus fumigatus, A. niger, A. flavus, Culturable, (35°C)	[Premium] Culture Method – 2 to 4 Agar Plates: MEA (35°C) *NEW: AccuScience AspergilloFAST*	FC-11-AFAST	3 days (Prelim.) and 7 days (Final): $60	NA
Fungi (Mold)	Surface Bulk/Liquid	TAPE Bulk	Fungi, Total (Non-Viable + Viable)	[Premium] High Performance Direct Microscopic Examination	FD-02HP	Std (3-5 days): $31 2 days: $35 24 hours: $40 6 hours: $60 3 hours: $95 Weekend: $120 Holiday: $200	Std (3-5 days): $65 2 days: $67 24 hours: $80 6 hours: $100 3 hours: $135 Weekend: $160 Holiday: $250
				[Premium] Triplicate High Performance Direct Microscopic Examination for Three Tape-Lifts From the Same Area	FD-02HP-TRI	Std (3-5 days): $43 2 days: $45 24 hours: $55 6 hours: $70 3 hours: $105 Weekend: $130	NA

Analyte	Matrix	Sample/Device	Analyte Type	Analysis	Code	TAT: Fee (VIP)	TAT: Fee (Regular)
Fungi (Mold)	Surface Bulk/Liquid	SWAB Bulk Dust	Fungi, Total (Non-Viable + Viable)	[Premium] Quantitative Direct Microscopic Exam™	FD-04HP	Std (3-5 days): $35 2 days: $38 24 hours: $45 6 hours: $60 3 hours: $95 Weekend: $120 Holiday: $200	Std (3-5 days): $65 2 days: $67 24 hours: $80 6 hours: $100 3 hours: $135 Weekend: $160 Holiday: $250
				[Premium] Quantitative Direct Microscopic Exam™ Triplicate Analysis With Precision Measurement (Intra-sample)	FD-04HP-PM	Std (3-5 days): $46 2 days: $48 24 hours: $55 6 hours: $70 3 hours: $105 Weekend: $130	NA
			Fungi, Total With Viability Rates	[Premium] Quantitative Direct Microscopic Exam™ With Viability Rates (by 24-48 Hour Spore Germination Test) *NEW: AccuScience ViableRATE*	FD-04HP-VR	Std (3-5 days): $65 2 days: $67 30 hours: $90 Weekend: $160	NA
			Fungi, Culturable, (25°C)	[Premium] Culture Method – 6 Agar Plates (1 MEA, 3 Mycologix MEA, 1 DG18, 1 Mycologix Cellulose Agar, 1 Collective Report)	FC-12HP	7 - 9 days: $40	7 - 9 days: $60
				[Premium] Culture Method – 6 Agar Plates (1 MEA, 3 Mycologix MEA, 1 DG18, 1 Mycologix Cellulose Agar, 1 Collective Report) *NEW: AccuScience FungiFAST*	FC-12HP-FFAST	5 days (Prelim.) and 7-9 days (Final): $57	NA
				[Premium] Culture Method – 8 Agar Plates (1 MEA, 3 Mycologix MEA, 3 DG18, 1 Mycologix Cellulose Agar, 2 Collective Reports)	FC-12HP-MEA/DG18	7 - 9 days: $65	NA
				[Premium] Culture Method – 6 Agar Plates (1 MEA, 3 Mycologix MEA, 3 DG18, 1 Mycologix Cellulose Agar, 2 Collective Reports) *NEW: AccuScience FungiFAST*	FC-12HP-MEA/DG18-FFAST	5 days (Prelim.) and 7-9 days (Final): $80	NA
			Fungi, Culturable and Total (Non-Viable + Viable)	FD-04HP and FC-12HP	FDC-12HP	4-5 days/7-9 days: $78	NA
				FD-04HP and FC-12HP-MEA/DG18	FDC-12HP MEA/DG18	4-5 days/7-9 days: $101	NA
Fungi (Mold)	Air Surface Bulk	Swab Bulk Filter Cassette	Fungal DNA	[Premium] (1) Mold-Specific Quantitative PCR - MSQPCR plus (2) High Performance Surface/Bulk Spore Count™	FPCR-36P	5 days: $325	NA

Analyte	Matrix	Sample/Device	Analyte Type	Analysis	Code	TAT: Fee (VIP)	TAT: Fee (Regular)
Other Microbiological Environmental Samples Testing							
Fungi & Bacteria	Surface Bulk/Liquid	SWAB Filter Cassette Bag/Tube/Bottle	Fungi and Bacteria , Culturable, (25°C)	FC-12HP and BC-12	FBC-12	7 - 9 days: $84	NA
Bacteria, general	Air	PURE-Plate	Bacteria, Culturable, (25°C)	Culture Method – 1 Agar Plate, 25°C	BC-11	7 - 9 days: $32	NA
	Surface Bulk	SWAB Bag/Tube/Bottle	Bacteria, Culturable, (25°C)	[Premium] Culture Method – 3 Media, 7 Agar Plates (3 TSA, 1 MSA//MSA and 3 MacConkey Agar)	BC-12	7 - 9 days: $42	NA
E. coli *Enterococcus* Total Coliforms Total Bacteria	Surface Bulk	Swab, Bulk	Bacteria, Culturable	[Premium] Culture Method – Quantitative Results (CFU/sample or CFU/in²)	SC-12P (Mon to Thu)	3 days: $80 2 days: $100 1 day: $120	NA
					SC-12P-W (Fri, Sat)	3 days: $110 2 days: $130 1 day: $150	NA
Thermophilic Actinomycetes	Surface Bulk, Air	Swab, Bottle, Bag	Thermophilic Actinomycetes, Culturable	Culture Method – (3 TSA) 55ºC	BC-14	14 days: $65	NA
Mycobacteria	Metal Working Fluid	Bottle	Mycobacterium, Viable	Culture Method – Middlebrook 7H11 Selective Agar	MC-12	21 days: $140	NA
Dust Particulates	Dust Air	Filter cassette Tape-lift Spore Traps	Indoor Environment Dust	Direct Microscopic Dust Characterization	PD-31	3 days: $75 2 days: $95 1 day: $120	NA

Consultation

Legal cases	Literature search and report writing	$400 per hour
	Deposition and Court Testimony	$450 per hour
Others		$300 per hour