Office of Pesticide Programs

Draft Guidance for Adding Efficacy Claims to Pre-saturated Antimicrobial Towelettes for Use on Hard, Non-porous Surfaces against Bacteria using a Standard Test Method, ASTM E3363

Date Revised: XX/XX/2024

Docket Number: EPA-HQ-OPP-2024-0414

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Quantitative Performance Evaluation of Antimicrobial Towelettes (QTM)

WK73519
2022 Pre-Interlaboratory Study
Phase 2

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1. Introduction

The U.S. EPA is leading the ongoing peer review of the draft standard "Quantitative Performance Evaluation of Antimicrobial Towelettes (Quantitative Towelette Method (QTM))" with ASTM workgroup WK73519. As part of this initiative, the Office of Pesticide Programs Microbiology Laboratory Branch (MLB) is seeking collaborative support in a preliminary interlaboratory study as a means of verifying the development of the draft method. ASTM regulations require precision statements in all test methods; results from this preliminary collaborative effort may be used to update the precision and bias statement included in the draft QTM standard prior to and/or following a successful ballot at the main committee (E35) level.

2. Study Goals

This collaborative effort will include two phases: 1) Familiarization phase, and 2) Pre-ILS; Phase 2; this protocol outlines Phase 2. Dry Clean-Wipes™ Dry Towelette (Clean-Wipes), a 50/50 blend of polypropylene synthetic and wood pulp/viscose natural cellulosic fibers, are used to simulate commercial wipes. Two test chemistries, BTC-835 (50% n-alkyl (50% C_{14}, 40% C_{12}, 10% C_{16}) dimethyl benzyl ammonium chlorides) and citric acid, will each be tested at two concentrations in addition to phosphate buffered saline + 0.1% (v/v) Tween 80 (PBS + 0.1% T80)); a total of five treatments will be evaluated.

3. Laboratories/Collaborators

Nine laboratories (collaborators) have agreed to participate in this study. The participating laboratories have existing microbiology programs, appropriately trained personnel, and the capability of conducting the study within the proposed timeframe. No specific certification is required for this study; however, staff performing the assays must be familiar with standard microbiological techniques such as aseptic transfer, serial dilutions, filtration, plate counts, and microbe identification. Each analyst involved in testing shall be knowledgeable of the Draft Quantitative Performance Evaluation of Antimicrobial Towelettes (v.071922[1]) and capable of accurately and independently conducting the procedure. Analysts performing the wiping component of the method should have completed Phase 1: Familiarization data collection before proceeding with Phase 2. Additional collaborators may be added, as necessary.

It is suggested that the labs establish a technical team to collect the data. The technical team is encouraged to conduct practice sessions in advance of the testing outlined in this protocol. The names and associated contact person for each laboratory are provided in Table 1. The identity of the laboratories will be coded and will not be identified in the data summary or final reports. See Table 1 for participating laboratories and corresponding contact information.

[1] Pre-ILS Familiarization phase protocol reflects method v.060122; minor revisions made to the draft method include 1) clarification of *Staphylococcus aureus* harvesting language, "entire contents (line 312)", 2) clarification of centrifuge time for harvested broth cultures of 20 min (line 314), and 3) clarification of Precision statement in Section 15 (line 576).

Table 1. Laboratories/Collaborators

Laboratory Name
1
2
3
4
5
6

4. Study Plan

Study Design

- The study design calls for evaluating 5, two-carrier sets per treatment; two randomized treatments will be evaluated per test day (10 total treated carriers).
- 3 control carriers are processed per test day; target control carrier counts in the range of 5.0 $\log_{10}$ CFU/carrier to 6.5 $\log_{10}$ CFU/carrier.
- Titer of the final test suspension will be evaluated for each test replicate for both organisms.
- See Table 2 for Study plan per test day, per test microbe.
- A total of three replications per treatment, per organism are required; thus, a total of 12 days will be required (6 test days per microbe). If desired, both organisms may be tested on one day.
    - Use a separate frozen stock culture for each replication.
- The order of testing for each test day should be: 1) control carrier #1, 2) five two-carrier sets assessed for the first treatment, 3) five two-carrier sets assessed for the second treatment, and 4) control carriers #2 and #3.
- One (primary) analyst performs the following critical elements each test day:
    - Prepare test culture
    - Prepare final test suspension
    - Inoculate carriers
    - Wipe treated carriers (wipes two-carrier sets for each treatment)
- Neutralization of treated carriers may be completed by a second (secondary) analyst.
    - Neutralization confirmation assay for Letheen broth was completed by EPA and found to be acceptable for treatments A, B, C, and D for both organisms; additional neutralization confirmation is not required.
- Preparation of serial dilutions and filtration of samples and diluted samples may be completed by either the primary or secondary analyst.
- **Submit the first replicate of data and paperwork for each test organism to EPA prior to additional testing.**

- Testing and data submission is anticipated to be completed by the end of December 2022.

Table 2: Study plan per test day, per test microbe

	Treated Carrier #	Treatment	Contact Time
One Test	1-5	A, B, C or D	5 min
	6-10	A, B, C, or D	5 min
	11-13	Controls (not wiped)	N/A

Methods and Paperwork:

- Labs must strictly follow the Quantitative Performance Evaluation of Antimicrobial Towelettes (Quantitative Towelette Method (QTM))" (v.071922) and the instructions for the Preparation and Dosing for Dry Clean-Wipes™ Dry Towelettes (Appendix A)
- MLB SOP MB-22-05: Preparation and Sampling Procedures for Antimicrobial Test Substances (treatments); see appropriate media prep sheets.
  - For preparation of two concentrations of BTC-835 and two concentrations of citric acid
- Standardized test forms and data sheets will be provided by the EPA

Materials (example sources and part numbers):

- Dry Towelette
  - Fisher Scientific, Catalog No. 06-664-14. Dry Clean-Wipes™
  - Thermo Scientific, Catalog No. 2903J81. Dry Clean-Wipes™
- Test Carriers: Pre-sterilized (non-coated) plastic (e.g., polystyrene) Petri plates, 120 mm x 20 mm.
  - labForce® (a Thomas Scientific Brand) Petri Dish, 150 x 20 mm, Slippable, Sterile, Bulk, 10/Pack, 100/Case; Product Number 1188N83
  - Corning Falcon® 150 mm x 20 mm Not TC-treated Bacteriological Petri Dish, 10/Pack, 100/Case, Sterile; Product Number 351058

Test Microbes:

- *Pseudomonas aeruginosa* (ATCC 15442) and *Staphylococcus aureus* (ATCC 6538); obtain from a reputable supplier (e.g., ATCC).
- Prepare frozen stock cultures of each test organism per Quantitative Towelette Method (v.071922), Attachment 1.

Media and Reagents: Prepare the media, reagents, and supplies necessary to conduct the steps outlined in the draft method to ensure they meet the quality and sterility required to conduct the assays. See list of media preparation sheets in Section 8 of this document.

Test Chemical: See Table 3 for test chemicals, active ingredient, use-dilution (diluted in sterile deionized water), recommended dilution filtered, and filters per dilution for both test organisms.

Neutralizer: Letheen broth

Table 3. Test Chemicals, Use-Dilution*, and Recommended Dilutions Filtered.

Organism	Treatment	Active Ingredient (AI)	Use-Dilution*	Recommended Dilutions Filtered	Filters per Dilution
P. aeruginosa	A	4000 ppm (0.4%) BTC-835	2500 ppm	10^0 , 10^{-1}	1
	B	4000 ppm (0.4%) BTC-835	500 ppm	10^0, 10^{-1}, 10^{-2}, 10^{-3}	1
	C	6000 ppm (0.6%) Citric Acid	(1 : 51)	10^0, 10^{-1}, 10^{-2}, 10^{-3}	1
	D	Phosphate Buffered Saline + 0.1% Tween 80	N/A	10^{-2}, 10^{-3}, 10^{-4}	1
	Controls	N/A	N/A	10^{-3}, 10^{-4}, 10^{-5}	1
S. aureus	A	4000 ppm (0.4%) BTC-835	2500 ppm	10^0 , 10^{-1}	1
	B	4000 ppm (0.4%) BTC-835	500 ppm	10^0, 10^{-1}, 10^{-2}, 10^{-3}	1
	C	6000 ppm (0.6%) Citric Acid	(1 : 21)	10^0, 10^{-1}, 10^{-2}	1
	D	Phosphate Buffered Saline + 0.1% Tween 80	N/A	10^{-2}, 10^{-3}, 10^{-4}	1
	Controls	N/A	N/A	10^{-3}, 10^{-4}, 10^{-5}	1

*Use-dilutions made with sterile, deionized water.

5. Documentation

- Utilize standardized test forms, data sheets, media preparation sheets, and spreadsheets provided by EPA.
- Maintain provided standardized documents to ensure that all studies are supported by complete, accurate, consistent, and chronological records from initial collection of raw data to final analysis interpretation and reporting of results.

- Upon completion of each study, a peer review of the data entry/tabulation should be performed by internal laboratory personnel prior to submitting to EPA.
- Scan and send completed standardized test forms, data sheets, and spreadsheets to EPA at the conclusion of the study. Scanned test forms, data sheets, and spreadsheets may be sent throughout data collection, if desired.
- Electronic spreadsheets and email correspondence will be considered as official documentation and will be maintained and stored accordingly.

6. Quality Assurance

- The expected level of quality assurance should be consistent with EPA Good Laboratory Practices.
- All entries should be made in permanent ink and should be complete. Each participating analyst should initial and date entries; documentation should indicate which analyst conducted which step of the experiment and at what time (when specified on the paperwork).
- Draw a line through all errors followed by a date, initials, and a brief explanation for the correction (codes may be used for common error types such as EE for entry error and EEO for entry error omission). Do not erase or use white out; the original entry should be visible.
- To correct a large section, block out with one diagonal line from corner to corner followed by a date, signature, and short explanation for the strike out. The original uncorrected section should still be visible.
- Track all preparations of treatments, media, and reagents using an assigned media preparation number.
- Inspect all supplies and materials considered "critical" to the quality of the research such as media and reagents, prior to use to ensure that the shipment has not been damaged or compromised in any way.
- For pre-sterilized lab supplies, the manufacturer's statement of sterility is acceptable for quality control documentation for sterility; no further testing is required.
- For growth media, conduct sterility and performance assessments (i.e., confirmation of sterility and suitability to support growth) a minimum of one time, preferably on the first batch prepared per lot.
- Deviations to the procedure should be documented and reported to the Study Director as soon as possible. Following consultation with the Study Director, the data will be deemed valid or invalid.
- Data may be rejected by the management of each laboratory or Quality Assurance Unit if the study is not performed correctly or if deviations to the procedure are not documented.
- Data may be rejected if microbial contamination occurs at an unacceptable level (if contamination is systemic or interferes with recording of results).

7. Data Collection Forms and Files

1) WK73519 QTM Organism Culture Tracking Form
2) WK73519 QTM Test Information Sheet
3) WK73519 QTM Serial Dilution/Plating/Titer Tracking Form
4) WK73519 QTM Results Sheet

5) WK73519 QTM Test Microbe Confirmation Sheet
6) WK73519 QTM Test Processing Sheet
7) WK73519 QTM Timing Sheet
8) WK73519 QTM Excel Spreadsheet: Results

8. Media Preparation Sheets

1) Tryptic Soy Broth (TSB) + 15% Glycerol
2) 5% Non-heat Inactivated Fetal Bovine Serum
3) Mucin
4) Yeast Extract
5) Bovine Serum Albumin
6) Tryptic Soy Agar (TSA)
7) Folded Dry Clean Wipes
8) Letheen Broth
9) Synthetic Broth
10) 10% Dextrose Solution
11) Phosphate Buffered Saline + 0.1% Tween 80
12) BTC-835 4000 ppm Stock Solution
13) BTC-835 2500 ppm Solution
14) BTC-835 500 ppm Solution
15) Citric Acid 1:51 Solution
16) Citric Acid 1:21 Solution

Appendix A

Instructions for the Preparation and Dosing for Dry Clean-Wipes™ Dry Towelette

Purpose: To prepare towelettes for the Quantitative Performance Evaluation of Antimicrobial Towelettes (QTM), WK73519, 2022 Pre-ILS Phase 2

Example Sources: Fisher Scientific, Catalog No. 06-664-14. Dry Clean-Wipes™
Thomas Scientific, Catalog No. 2903J81. Dry Clean-Wipes™

Preparation

Note: Dry Clean-Wipes™ are sterile in sealed cannister. Prepare (individually fold) all towelettes to be used in advance of each test day, include 2-3 extras. Prepared towelettes may be used for up to 5 days; after 5 days, discard.

1) Clean/disinfect the cap/lid area of the cannister with 70% (v/v) ethanol.
2) Use a new pair of sterile gloves (or non-sterile gloves sprayed with 70% (v/v) ethanol) when preparing to handle each test towelette.
3) Unfold and refold as described in WK73519 Quantitative Performance Evaluation of Antimicrobial Towelettes (v.071922) section 13.3.7.
4) Place each individual folded dry towelette into a clean, sterile plastic (e.g., polystyrene, nalgene, etc.) or glass (150 mm x 15 mm) Petri dish at room temperature (e.g., 21°C ± 4°C) and cover (see Figure 1).

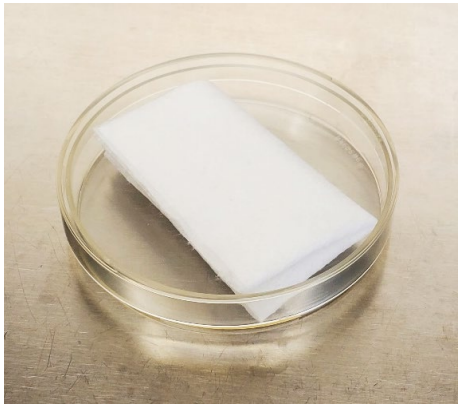

Figure 1: Folded Dry Clean-Wipe in sterile, reusable Nalgene Petri dish.

5) Each individual folded towelette remains in the same sterile Petri dish for dosing and until used for testing.

Treatment

1) Remove lid of Petri dish and gently pipette 4 mL of treatment over the surface of the folded dry towelette (towelette remains inside sterile Petri dish).
2) Ensure the entire surface is covered; avoid trapping any air bubbles between the towelette and the Petri dish. To ensure proper saturation of the treatment, pipette may be used to press towelette into treatment or the towelette may be managed using sterile forceps.
    a. After dosing of all towelettes is complete, let wetted towelettes stand for 20 min ± 30 sec (dosing time). Do not start timer until the last towelette is dosed.
    b. Do not refill serological pipettes when dosing: use one individual serological pipette to dose one towelette, or, use one large volume individual serological pipette to dose multiple towelettes, then discard.
    c. All towelettes must be used for testing within 30 minutes after dosing time end.
3) Follow test procedures as outlined in WK73519 Quantitative Performance Evaluation of Antimicrobial Towelettes (v.071922).

Quantitative Performance Evaluation of Antimicrobial Towelettes (QTM)

WK73519
2022/2023/2024 Pre-Interlaboratory Study
Phase 3

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2. Study Goals

This collaborative effort will include three phases: 1) Familiarization phase, 2) Pre-ILS; Phase 2, and 3) Continuation; Phase 3; this protocol outlines Phase 3. A pre-saturated quaternary ammonium-based towelette will be tested to simulate a highly efficacious product.

3. Laboratories/Collaborators

Six laboratories (collaborators) have agreed to participate in this study. The participating laboratories have existing microbiology programs, appropriately trained personnel, and the capability of conducting the study within the proposed timeframe. No specific certification is required for this study; however, staff performing the assays must be familiar with standard microbiological techniques such as aseptic transfer, serial dilutions, filtration, plate counts, and microbe identification. Each analyst involved in testing shall be knowledgeable of the Draft Quantitative Performance Evaluation of Antimicrobial Towelettes (v.071922[1]) and capable of accurately and independently conducting the procedure. Analysts performing the wiping component of the method should have completed Phase 1: Familiarization data collection before continuing with Phase 3. Additional collaborators may be added, as necessary.

It is suggested that the labs establish a technical team to collect the data. The technical team is encouraged to conduct practice sessions in advance of the testing outlined in this protocol. The names and associated contact person for each laboratory are provided in Table 1. The identity of the laboratories will be coded and will not be identified in the data summary or final reports. See Table 1 for participating laboratories and corresponding contact information.

[1] Pre-ILS Familiarization phase protocol reflects method v.060122; minor revisions made to the draft method include 1) clarification of *Staphylococcus aureus* harvesting language, "entire contents (line 312)", 2) clarification of centrifuge time for harvested broth cultures of 20 min (line 314), and 3) clarification of Precision statement in Section 15 (line 576).

Table 1. Laboratories/Collaborators

Laboratory Names
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4. Study Plan

Study Design

- The study design calls for evaluating 5, two-carrier sets per treatment; one treatment will be evaluated per test day (5 total treated carriers).
- 2 organisms will be tested: *Staphylococcus aureus* and *Pseudomonas aeruginosa*
- 3 control carriers are processed per test day; target control carrier counts in the range of 5.0 to 6.5 $\log_{10}$ CFU/carrier.
- Titer of the final test suspension will be evaluated for each test replicate for both organisms.
- See Table 2 for Study plan per test day, per test microbe.
- A total of three replications per treatment, per organism are required; thus, a total of 6 days will be required (3 test days per microbe). If desired, both organisms may be tested on one day.
    - Use a separate frozen stock culture for each replication.
- The order of testing for each test day should be: 1) control carrier #1, 2) five two-carrier sets assessed for the treatment, and 3) control carriers #2 and #3.
    - Each treated carrier set (5 total) must be evaluated individually.
- One (primary) analyst performs the following critical elements each test day:
    - Prepare test culture
    - Prepare final test suspension
    - Inoculate carriers
    - Wipe treated carriers (wipes two-carrier sets for each treatment)
- Neutralization of treated carriers may be completed by a second (secondary) analyst.
    - Neutralization confirmation assay for Letheen broth was completed by EPA and found to be acceptable for treatment E for both organisms; additional neutralization confirmation is not required.
- Preparation of serial dilutions and filtration of samples and diluted samples may be completed by either the primary or secondary analyst.
- **Submit the first replicate of data and paperwork for each test organism to EPA prior to additional testing.**
- Testing and data submission is anticipated to be completed by the end of March 2024.

Table 2: Study plan per test day, per test microbe

	Treated Carrier #	Treatment	Contact Time
One Test	1-5	E	5 minutes
	6-8	Controls (not wiped)	N/A

Methods and Paperwork:

- Labs must strictly follow the Quantitative Performance Evaluation of Antimicrobial Towelettes (Quantitative Towelette Method (QTM)) (v.071922)
- Standardized test forms and data sheets will be provided by the EPA

Materials (example sources and part numbers):

- Test Carriers: Pre-sterilized (non-coated) plastic (e.g., polystyrene) Petri plates, 120 mm x 20 mm.
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Test Chemical: See Table 3 for test chemical, active ingredient, recommended dilutions to be filtered, and filters per dilution for each test organism.

Neutralizer: Letheen broth

Table 3. Test Chemicals and Recommended Dilutions Filtered.

Organism	Treatment	Active Ingredient (AI)	Contact Time	Recommended Dilutions Filtered	Filters per Dilution
P. aeruginosa	E	Quaternary Ammonium Compound	5 minutes	10^0, 10^{-1}	1
	Controls	N/A	N/A	10^{-3}, 10^{-4}, 10^{-5}	1
S. aureus	E	Quaternary Ammonium Compound	5 minutes	10^0, 10^{-1}	1

	Controls	N/A	N/A	10^{-3}, 10^{-4}, 10^{-5}	1

5. Documentation

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- For growth media, conduct sterility and performance assessments (i.e., confirmation of sterility and suitability to support growth) a minimum of one time, preferably on the first batch prepared per lot.
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8) WK73519 QTM Excel Spreadsheet: Results

8. Media Preparation Sheets

1) Tryptic Soy Broth (TSB)
2) Tryptic Soy Broth (TSB) + 15% Glycerol
3) 5% Non-heat Inactivated Fetal Bovine Serum
4) Mucin
5) Yeast Extract
6) Bovine Serum Albumin
7) Tryptic Soy Agar (TSA)
8) Letheen Broth
9) Synthetic Broth
10) 10% Dextrose Solution

Quantitative Performance Evaluation of Antimicrobial Towelettes (QTM): Phase 2 Data Compilation

Log Density of Control Carriers			
Lab	Test Chemical	Organism	Log Density per Carrier
1	Controls	P. aeruginosa	6.584331
1	Controls	P. aeruginosa	6.158362
1	Controls	P. aeruginosa	6.326336
1	Controls	P. aeruginosa	6.471292
1	Controls	P. aeruginosa	6.170262
1	Controls	P. aeruginosa	6.264818
1	Controls	P. aeruginosa	6.428135
1	Controls	P. aeruginosa	6.214844
1	Controls	P. aeruginosa	6.225309
1	Controls	P. aeruginosa	6.264818
1	Controls	P. aeruginosa	6.380211
1	Controls	P. aeruginosa	6.401401
1	Controls	P. aeruginosa	6.274158
1	Controls	P. aeruginosa	6.064458
1	Controls	P. aeruginosa	5.982271
1	Controls	P. aeruginosa	6.235528
1	Controls	P. aeruginosa	6.033424
1	Controls	P. aeruginosa	5.903090
2	Controls	P. aeruginosa	5.561101
2	Controls	P. aeruginosa	5.414973
2	Controls	P. aeruginosa	5.440909
2	Controls	P. aeruginosa	5.786751
2	Controls	P. aeruginosa	5.772322
2	Controls	P. aeruginosa	5.824776
2	Controls	P. aeruginosa	5.887617
2	Controls	P. aeruginosa	6.133539
2	Controls	P. aeruginosa	6.158362
2	Controls	P. aeruginosa	5.673942
2	Controls	P. aeruginosa	5.570543
2	Controls	P. aeruginosa	5.561101
2	Controls	P. aeruginosa	5.428135
2	Controls	P. aeruginosa	5.318063
2	Controls	P. aeruginosa	5.515874
2	Controls	P. aeruginosa	6.235528
2	Controls	P. aeruginosa	5.963788
2	Controls	P. aeruginosa	6.033424
3	Controls	P. aeruginosa	5.655138
3	Controls	P. aeruginosa	5.049218
3	Controls	P. aeruginosa	5.357935
3	Controls	P. aeruginosa	5.635484
3	Controls	P. aeruginosa	5.204120
3	Controls	P. aeruginosa	5.274158
3	Controls	P. aeruginosa	5.647383
3	Controls	P. aeruginosa	5.408240
3	Controls	P. aeruginosa	5.357935
3	Controls	P. aeruginosa	6.619093

3	Controls	P. aeruginosa	5.980458
3	Controls	P. aeruginosa	5.866878
3	Controls	P. aeruginosa	6.204120
3	Controls	P. aeruginosa	5.741939
3	Controls	P. aeruginosa	5.702431
3	Controls	P. aeruginosa	5.264818
3	Controls	P. aeruginosa	5.255273
3	Controls	P. aeruginosa	5.181844
4	Controls	P. aeruginosa	5.889862
4	Controls	P. aeruginosa	5.488551
4	Controls	P. aeruginosa	5.440909
4	Controls	P. aeruginosa	5.662758
4	Controls	P. aeruginosa	5.394452
4	Controls	P. aeruginosa	5.453318
4	Controls	P. aeruginosa	5.677607
4	Controls	P. aeruginosa	5.584331
4	Controls	P. aeruginosa	5.546543
4	Controls	P. aeruginosa	5.722634
4	Controls	P. aeruginosa	5.434569
4	Controls	P. aeruginosa	5.372912
4	Controls	P. aeruginosa	5.778151
4	Controls	P. aeruginosa	5.695482
4	Controls	P. aeruginosa	5.702431
4	Controls	P. aeruginosa	6.017033
4	Controls	P. aeruginosa	5.712650
4	Controls	P. aeruginosa	5.651278
5	Controls	P. aeruginosa	5.760422
5	Controls	P. aeruginosa	5.781037
5	Controls	P. aeruginosa	5.688420
5	Controls	P. aeruginosa	5.903090
5	Controls	P. aeruginosa	5.597695
5	Controls	P. aeruginosa	5.610660
5	Controls	P. aeruginosa	6.334454
5	Controls	P. aeruginosa	5.688420
5	Controls	P. aeruginosa	5.876218
5	Controls	P. aeruginosa	6.120574
5	Controls	P. aeruginosa	5.722634
5	Controls	P. aeruginosa	5.691965
5	Controls	P. aeruginosa	5.982271
5	Controls	P. aeruginosa	5.614897
5	Controls	P. aeruginosa	5.783904
5	Controls	P. aeruginosa	5.806180
5	Controls	P. aeruginosa	5.482874
5	Controls	P. aeruginosa	5.459392
6	Controls	P. aeruginosa	6.170262
6	Controls	P. aeruginosa	5.982271
6	Controls	P. aeruginosa	5.797960
6	Controls	P. aeruginosa	6.245513
6	Controls	P. aeruginosa	6.033424

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6	Controls	P. aeruginosa	6.033424
6	Controls	P. aeruginosa	6.120574
6	Controls	P. aeruginosa	5.880814
6	Controls	P. aeruginosa	6.170262
6	Controls	P. aeruginosa	6.017033
6	Controls	P. aeruginosa	5.769377
6	Controls	P. aeruginosa	6.033424
6	Controls	P. aeruginosa	5.936514
6	Controls	P. aeruginosa	5.695482
6	Controls	P. aeruginosa	6.000000
6	Controls	P. aeruginosa	6.000000
6	Controls	P. aeruginosa	5.792392
1	Controls	S. aureus	6.204120
1	Controls	S. aureus	6.334454
1	Controls	S. aureus	6.214844
1	Controls	S. aureus	6.245513
1	Controls	S. aureus	6.342423
1	Controls	S. aureus	6.326336
1	Controls	S. aureus	6.357935
1	Controls	S. aureus	6.326336
1	Controls	S. aureus	6.301030
1	Controls	S. aureus	6.334454
1	Controls	S. aureus	6.274158
1	Controls	S. aureus	6.365488
1	Controls	S. aureus	6.235528
1	Controls	S. aureus	6.309630
1	Controls	S. aureus	6.309630
1	Controls	S. aureus	6.274158
1	Controls	S. aureus	6.421604
1	Controls	S. aureus	6.301030
2	Controls	S. aureus	6.000000
2	Controls	S. aureus	5.859739
2	Controls	S. aureus	5.887617
2	Controls	S. aureus	6.158362
2	Controls	S. aureus	6.079181
2	Controls	S. aureus	6.000000
2	Controls	S. aureus	6.064458
2	Controls	S. aureus	6.064458
2	Controls	S. aureus	6.107210
2	Controls	S. aureus	6.079181
2	Controls	S. aureus	6.120574
2	Controls	S. aureus	6.120574
2	Controls	S. aureus	6.170262
2	Controls	S. aureus	6.093422
2	Controls	S. aureus	6.079181
2	Controls	S. aureus	6.274158
2	Controls	S. aureus	6.158362
2	Controls	S. aureus	6.193125

3	Controls	S. aureus	6.471292
3	Controls	S. aureus	6.453318
3	Controls	S. aureus	6.428135
3	Controls	S. aureus	5.541579
3	Controls	S. aureus	5.651278
3	Controls	S. aureus	5.584331
3	Controls	S. aureus	6.097604
3	Controls	S. aureus	6.053846
3	Controls	S. aureus	6.082067
3	Controls	S. aureus	6.093422
3	Controls	S. aureus	6.158362
3	Controls	S. aureus	6.181844
3	Controls	S. aureus	6.292256
3	Controls	S. aureus	6.334454
3	Controls	S. aureus	6.292256
3	Controls	S. aureus	5.741939
3	Controls	S. aureus	5.691965
3	Controls	S. aureus	5.729165
4	Controls	S. aureus	6.292256
4	Controls	S. aureus	6.255273
4	Controls	S. aureus	6.292256
4	Controls	S. aureus	6.283301
4	Controls	S. aureus	6.225309
4	Controls	S. aureus	6.107210
4	Controls	S. aureus	6.357935
4	Controls	S. aureus	6.255273
4	Controls	S. aureus	6.309630
4	Controls	S. aureus	6.264818
4	Controls	S. aureus	6.264818
4	Controls	S. aureus	6.079181
4	Controls	S. aureus	6.292256
4	Controls	S. aureus	6.245513
4	Controls	S. aureus	6.334454
4	Controls	S. aureus	6.421604
4	Controls	S. aureus	6.292256
4	Controls	S. aureus	6.357935
5	Controls	S. aureus	6.387390
5	Controls	S. aureus	6.318063
5	Controls	S. aureus	6.350248
5	Controls	S. aureus	6.357935
5	Controls	S. aureus	6.079181
5	Controls	S. aureus	6.107210
5	Controls	S. aureus	5.769377
5	Controls	S. aureus	5.732394
5	Controls	S. aureus	5.754348
5	Controls	S. aureus	6.274158
5	Controls	S. aureus	5.932474
5	Controls	S. aureus	5.963788
5	Controls	S. aureus	6.318063

5	Controls	S. aureus	6.093422
5	Controls	S. aureus	6.033424
5	Controls	S. aureus	6.394452
5	Controls	S. aureus	6.214844
5	Controls	S. aureus	5.924279
6	Controls	S. aureus	6.309630
6	Controls	S. aureus	6.170262
6	Controls	S. aureus	6.133539
6	Controls	S. aureus	6.235528
6	Controls	S. aureus	6.264818
6	Controls	S. aureus	6.000000
6	Controls	S. aureus	6.318063
6	Controls	S. aureus	6.387390
6	Controls	S. aureus	6.264818
6	Controls	S. aureus	6.401401
6	Controls	S. aureus	6.357935
6	Controls	S. aureus	6.326336
6	Controls	S. aureus	6.387390
6	Controls	S. aureus	6.318063
6	Controls	S. aureus	6.401401
6	Controls	S. aureus	6.235528
6	Controls	S. aureus	6.264818
6	Controls	S. aureus	6.133539

Log Density of Treated Carriers			
Lab	Test Chemical	Organism	Log Density per Carrier
1	B	P. aeruginosa	4.326336
1	B	P. aeruginosa	4.255273
1	B	P. aeruginosa	4.655138
1	B	P. aeruginosa	4.584331
1	B	P. aeruginosa	3.579784
1	C	P. aeruginosa	2.924279
1	C	P. aeruginosa	3.245513
1	C	P. aeruginosa	3.482874
1	C	P. aeruginosa	2.021189
1	C	P. aeruginosa	3.245513
1	A	P. aeruginosa	0.000000
1	A	P. aeruginosa	0.000000
1	A	P. aeruginosa	0.000000
1	A	P. aeruginosa	0.000000
1	A	P. aeruginosa	0.000000
1	D	P. aeruginosa	4.283301
1	D	P. aeruginosa	4.551450
1	D	P. aeruginosa	4.387390
1	D	P. aeruginosa	4.655138
1	D	P. aeruginosa	4.465383
1	C	P. aeruginosa	2.000000
1	C	P. aeruginosa	1.934498
1	C	P. aeruginosa	2.778151
1	C	P. aeruginosa	1.690196
1	C	P. aeruginosa	3.283301
1	D	P. aeruginosa	4.079181
1	D	P. aeruginosa	4.245513
1	D	P. aeruginosa	4.357935
1	D	P. aeruginosa	4.264818
1	D	P. aeruginosa	4.380211
1	A	P. aeruginosa	0.000000
1	A	P. aeruginosa	1.491362
1	A	P. aeruginosa	0.000000
1	A	P. aeruginosa	0.000000
1	A	P. aeruginosa	0.000000
1	B	P. aeruginosa	2.643453
1	B	P. aeruginosa	2.643453
1	B	P. aeruginosa	2.556303
1	B	P. aeruginosa	2.380211
1	B	P. aeruginosa	2.806180
1	B	P. aeruginosa	2.778151
1	B	P. aeruginosa	2.447158

1	B	P. aeruginosa	1.707570
1	B	P. aeruginosa	1.579784
1	B	P. aeruginosa	2.041393
1	C	P. aeruginosa	2.681241
1	C	P. aeruginosa	2.380211
1	C	P. aeruginosa	1.447158
1	C	P. aeruginosa	3.510545
1	C	P. aeruginosa	2.505150
1	A	P. aeruginosa	0.000000
1	A	P. aeruginosa	0.000000
1	A	P. aeruginosa	0.000000
1	A	P. aeruginosa	0.000000
1	A	P. aeruginosa	0.000000
1	D	P. aeruginosa	3.924279
1	D	P. aeruginosa	4.301030
1	D	P. aeruginosa	3.748188
1	D	P. aeruginosa	3.903090
1	D	P. aeruginosa	4.158362
2	B	P. aeruginosa	3.000000
2	B	P. aeruginosa	2.127105
2	B	P. aeruginosa	2.271842
2	B	P. aeruginosa	2.505150
2	B	P. aeruginosa	2.161368
2	A	P. aeruginosa	0.000000
2	A	P. aeruginosa	1.146128
2	A	P. aeruginosa	0.000000
2	A	P. aeruginosa	0.000000
2	A	P. aeruginosa	0.000000
2	D	P. aeruginosa	4.017033
2	D	P. aeruginosa	3.505150
2	D	P. aeruginosa	3.716003
2	D	P. aeruginosa	4.133539
2	D	P. aeruginosa	3.447158
2	C	P. aeruginosa	3.394452
2	C	P. aeruginosa	3.447158
2	C	P. aeruginosa	3.819544
2	C	P. aeruginosa	3.944483
2	C	P. aeruginosa	3.318063
2	C	P. aeruginosa	4.963788
2	C	P. aeruginosa	4.225309
2	C	P. aeruginosa	3.889862
2	C	P. aeruginosa	4.769377
2	C	P. aeruginosa	3.627366
2	B	P. aeruginosa	3.754348
2	B	P. aeruginosa	4.434569
2	B	P. aeruginosa	5.283301
2	B	P. aeruginosa	4.301030

2	B	P. aeruginosa	4.606381
2	D	P. aeruginosa	3.963788
2	D	P. aeruginosa	2.903090
2	D	P. aeruginosa	2.903090
2	D	P. aeruginosa	3.556303
2	D	P. aeruginosa	4.158362
2	A	P. aeruginosa	0.000000
2	A	P. aeruginosa	0.000000
2	A	P. aeruginosa	0.000000
2	A	P. aeruginosa	0.000000
2	A	P. aeruginosa	3.204120
2	D	P. aeruginosa	4.017033
2	D	P. aeruginosa	3.857332
2	D	P. aeruginosa	4.235528
2	D	P. aeruginosa	4.000000
2	D	P. aeruginosa	4.158362
2	C	P. aeruginosa	4.193125
2	C	P. aeruginosa	3.738781
2	C	P. aeruginosa	4.521138
2	C	P. aeruginosa	3.235528
2	C	P. aeruginosa	3.531479
2	B	P. aeruginosa	3.434569
2	B	P. aeruginosa	3.885361
2	B	P. aeruginosa	2.716003
2	B	P. aeruginosa	2.053078
2	B	P. aeruginosa	3.778151
2	A	P. aeruginosa	3.033424
2	A	P. aeruginosa	3.903090
2	A	P. aeruginosa	3.903090
2	A	P. aeruginosa	0.000000
2	A	P. aeruginosa	2.301030
3	C	P. aeruginosa	3.170262
3	C	P. aeruginosa	3.864511
3	C	P. aeruginosa	3.691965
3	C	P. aeruginosa	3.499687
3	C	P. aeruginosa	3.079181
3	A	P. aeruginosa	3.342423
3	A	P. aeruginosa	2.806180
3	A	P. aeruginosa	2.045323
3	A	P. aeruginosa	3.000000
3	A	P. aeruginosa	3.570543
3	B	P. aeruginosa	3.658965
3	B	P. aeruginosa	4.459392
3	B	P. aeruginosa	4.245513
3	B	P. aeruginosa	4.017033
3	B	P. aeruginosa	4.264818
3	D	P. aeruginosa	3.380211

3	D	P. aeruginosa	4.093422
3	D	P. aeruginosa	4.556303
3	D	P. aeruginosa	3.924279
3	D	P. aeruginosa	4.107210
3	D	P. aeruginosa	4.245513
3	D	P. aeruginosa	3.982271
3	D	P. aeruginosa	3.778151
3	D	P. aeruginosa	3.924279
3	D	P. aeruginosa	3.806180
3	A	P. aeruginosa	0.698970
3	A	P. aeruginosa	1.579784
3	A	P. aeruginosa	1.851258
3	A	P. aeruginosa	3.170262
3	A	P. aeruginosa	0.000000
3	C	P. aeruginosa	2.963788
3	C	P. aeruginosa	1.301030
3	C	P. aeruginosa	1.653213
3	C	P. aeruginosa	3.093422
3	C	P. aeruginosa	2.029384
3	B	P. aeruginosa	4.741939
3	B	P. aeruginosa	4.754348
3	B	P. aeruginosa	5.158362
3	B	P. aeruginosa	4.808886
3	B	P. aeruginosa	4.551450
3	B	P. aeruginosa	4.193125
3	B	P. aeruginosa	4.245513
3	B	P. aeruginosa	4.551450
3	B	P. aeruginosa	4.575188
3	B	P. aeruginosa	4.627366
3	C	P. aeruginosa	4.372912
3	C	P. aeruginosa	3.930440
3	C	P. aeruginosa	3.903090
3	C	P. aeruginosa	2.324282
3	C	P. aeruginosa	4.133539
3	A	P. aeruginosa	2.832509
3	A	P. aeruginosa	3.283301
3	A	P. aeruginosa	3.245513
3	A	P. aeruginosa	3.488551
3	A	P. aeruginosa	0.845098
3	D	P. aeruginosa	4.120574
3	D	P. aeruginosa	3.748188
3	D	P. aeruginosa	4.440909
3	D	P. aeruginosa	4.225309
3	D	P. aeruginosa	3.778151
4	A	P. aeruginosa	0.000000
4	A	P. aeruginosa	0.000000
4	A	P. aeruginosa	0.000000

4	A	P. aeruginosa	0.000000
4	A	P. aeruginosa	0.000000
4	B	P. aeruginosa	2.857332
4	B	P. aeruginosa	2.602060
4	B	P. aeruginosa	2.778151
4	B	P. aeruginosa	2.716003
4	B	P. aeruginosa	3.606381
4	C	P. aeruginosa	1.431364
4	C	P. aeruginosa	2.602060
4	C	P. aeruginosa	1.477121
4	C	P. aeruginosa	2.748188
4	C	P. aeruginosa	2.643453
4	D	P. aeruginosa	4.387390
4	D	P. aeruginosa	4.064458
4	D	P. aeruginosa	4.079181
4	D	P. aeruginosa	4.705864
4	D	P. aeruginosa	3.924279
4	D	P. aeruginosa	4.290522
4	D	P. aeruginosa	4.710916
4	D	P. aeruginosa	4.664784
4	D	P. aeruginosa	4.524606
4	D	P. aeruginosa	4.486817
4	B	P. aeruginosa	2.602060
4	B	P. aeruginosa	3.447158
4	B	P. aeruginosa	3.465383
4	B	P. aeruginosa	3.556303
4	B	P. aeruginosa	2.301030
4	C	P. aeruginosa	3.301030
4	C	P. aeruginosa	3.526339
4	C	P. aeruginosa	3.556303
4	C	P. aeruginosa	3.350248
4	C	P. aeruginosa	3.521138
4	A	P. aeruginosa	1.278754
4	A	P. aeruginosa	1.000000
4	A	P. aeruginosa	1.875061
4	A	P. aeruginosa	0.477121
4	A	P. aeruginosa	0.000000
4	D	P. aeruginosa	4.556303
4	D	P. aeruginosa	4.494155
4	D	P. aeruginosa	4.593286
4	D	P. aeruginosa	4.536558
4	D	P. aeruginosa	4.677607
4	C	P. aeruginosa	3.283301
4	C	P. aeruginosa	3.471292
4	C	P. aeruginosa	3.093422
4	C	P. aeruginosa	3.482874
4	C	P. aeruginosa	3.350248

4	A	P. aeruginosa	0.000000
4	A	P. aeruginosa	0.602060
4	A	P. aeruginosa	0.000000
4	A	P. aeruginosa	0.000000
4	A	P. aeruginosa	0.000000
4	B	P. aeruginosa	2.556303
4	B	P. aeruginosa	2.903090
4	B	P. aeruginosa	3.107210
4	B	P. aeruginosa	2.643453
4	B	P. aeruginosa	2.380211
5	C	P. aeruginosa	1.397940
5	C	P. aeruginosa	2.184691
5	C	P. aeruginosa	1.568202
5	C	P. aeruginosa	0.602060
5	C	P. aeruginosa	2.556303
5	B	P. aeruginosa	0.845098
5	B	P. aeruginosa	0.903090
5	B	P. aeruginosa	0.000000
5	B	P. aeruginosa	3.643453
5	B	P. aeruginosa	2.281033
5	A	P. aeruginosa	0.000000
5	A	P. aeruginosa	2.198657
5	A	P. aeruginosa	0.301030
5	A	P. aeruginosa	1.908485
5	A	P. aeruginosa	2.505150
5	D	P. aeruginosa	3.447158
5	D	P. aeruginosa	4.079181
5	D	P. aeruginosa	3.944483
5	D	P. aeruginosa	3.778151
5	D	P. aeruginosa	3.681241
5	B	P. aeruginosa	4.120574
5	B	P. aeruginosa	3.204120
5	B	P. aeruginosa	3.434569
5	B	P. aeruginosa	1.278754
5	B	P. aeruginosa	1.954243
5	A	P. aeruginosa	0.000000
5	A	P. aeruginosa	2.982271
5	A	P. aeruginosa	0.000000
5	A	P. aeruginosa	0.000000
5	A	P. aeruginosa	2.380211
5	A	P. aeruginosa	0.000000
5	A	P. aeruginosa	3.309630
5	A	P. aeruginosa	0.301030
5	A	P. aeruginosa	1.785330
5	A	P. aeruginosa	3.033424
5	D	P. aeruginosa	3.778151
5	D	P. aeruginosa	3.806180

5	D	P. aeruginosa	3.924279
5	D	P. aeruginosa	3.716003
5	D	P. aeruginosa	3.924279
5	D	P. aeruginosa	3.602060
5	D	P. aeruginosa	3.832509
5	D	P. aeruginosa	3.778151
5	D	P. aeruginosa	4.093422
5	D	P. aeruginosa	3.643453
5	C	P. aeruginosa	0.000000
5	C	P. aeruginosa	0.602060
5	C	P. aeruginosa	0.000000
5	C	P. aeruginosa	0.000000
5	C	P. aeruginosa	0.000000
5	B	P. aeruginosa	2.681241
5	B	P. aeruginosa	3.477121
5	B	P. aeruginosa	1.531479
5	B	P. aeruginosa	2.806180
5	B	P. aeruginosa	3.000000
5	C	P. aeruginosa	0.000000
5	C	P. aeruginosa	0.000000
5	C	P. aeruginosa	0.000000
5	C	P. aeruginosa	0.845098
5	C	P. aeruginosa	0.602060
6	A	P. aeruginosa	1.903090
6	A	P. aeruginosa	3.283301
6	A	P. aeruginosa	0.000000
6	A	P. aeruginosa	0.000000
6	A	P. aeruginosa	0.000000
6	B	P. aeruginosa	3.827369
6	B	P. aeruginosa	4.655138
6	B	P. aeruginosa	4.551450
6	B	P. aeruginosa	4.301030
6	B	P. aeruginosa	4.107210
6	C	P. aeruginosa	3.245513
6	C	P. aeruginosa	3.651278
6	C	P. aeruginosa	3.477121
6	C	P. aeruginosa	4.146128
6	C	P. aeruginosa	2.832509
6	D	P. aeruginosa	4.847573
6	D	P. aeruginosa	4.666518
6	D	P. aeruginosa	4.878522
6	D	P. aeruginosa	4.049218
6	D	P. aeruginosa	4.561101
6	D	P. aeruginosa	4.515874
6	D	P. aeruginosa	4.546543
6	D	P. aeruginosa	4.859739
6	D	P. aeruginosa	4.614897

6	D	P. aeruginosa	4.181844
6	C	P. aeruginosa	3.666518
6	C	P. aeruginosa	3.428135
6	C	P. aeruginosa	3.565848
6	C	P. aeruginosa	2.982271
6	C	P. aeruginosa	2.447158
6	A	P. aeruginosa	1.740363
6	A	P. aeruginosa	0.000000
6	A	P. aeruginosa	0.000000
6	A	P. aeruginosa	0.000000
6	A	P. aeruginosa	2.944483
6	B	P. aeruginosa	3.873902
6	B	P. aeruginosa	3.408240
6	B	P. aeruginosa	3.647383
6	B	P. aeruginosa	2.806180
6	B	P. aeruginosa	3.414973
6	B	P. aeruginosa	3.905256
6	B	P. aeruginosa	3.235528
6	B	P. aeruginosa	4.593286
6	B	P. aeruginosa	3.408240
6	B	P. aeruginosa	3.342423
6	A	P. aeruginosa	0.000000
6	A	P. aeruginosa	0.477121
6	A	P. aeruginosa	0.000000
6	A	P. aeruginosa	2.060698
6	A	P. aeruginosa	0.000000
6	D	P. aeruginosa	4.465383
6	D	P. aeruginosa	4.806180
6	D	P. aeruginosa	4.541579
6	D	P. aeruginosa	4.837588
6	D	P. aeruginosa	4.214844
6	C	P. aeruginosa	4.214844
6	C	P. aeruginosa	4.079181
6	C	P. aeruginosa	3.079181
6	C	P. aeruginosa	2.880814
6	C	P. aeruginosa	3.049218
1	B	S. aureus	3.301030
1	B	S. aureus	3.274158
1	B	S. aureus	3.235528
1	B	S. aureus	3.845098
1	B	S. aureus	3.593286
1	C	S. aureus	3.214844
1	C	S. aureus	3.639486
1	C	S. aureus	3.584331
1	C	S. aureus	2.857332
1	C	S. aureus	2.806180
1	D	S. aureus	4.666518

1	D	S. aureus	4.146128
1	D	S. aureus	4.729165
1	D	S. aureus	4.614897
1	D	S. aureus	4.769377
1	A	S. aureus	0.477121
1	A	S. aureus	0.000000
1	A	S. aureus	0.000000
1	A	S. aureus	0.000000
1	A	S. aureus	0.000000
1	B	S. aureus	3.465383
1	B	S. aureus	3.408240
1	B	S. aureus	3.033424
1	B	S. aureus	2.903090
1	B	S. aureus	3.146128
1	C	S. aureus	2.778151
1	C	S. aureus	3.107210
1	C	S. aureus	3.365488
1	C	S. aureus	3.133539
1	C	S. aureus	3.342423
1	D	S. aureus	4.170262
1	D	S. aureus	4.193125
1	D	S. aureus	4.033424
1	D	S. aureus	4.000000
1	D	S. aureus	3.924279
1	A	S. aureus	0.000000
1	A	S. aureus	0.000000
1	A	S. aureus	0.845098
1	A	S. aureus	0.000000
1	A	S. aureus	0.778151
1	B	S. aureus	2.982271
1	B	S. aureus	2.832509
1	B	S. aureus	2.924279
1	B	S. aureus	2.447158
1	B	S. aureus	3.049218
1	C	S. aureus	3.365488
1	C	S. aureus	3.079181
1	C	S. aureus	3.350248
1	C	S. aureus	3.181844
1	C	S. aureus	3.394452
1	A	S. aureus	0.000000
1	A	S. aureus	0.000000
1	A	S. aureus	0.000000
1	A	S. aureus	0.000000
1	A	S. aureus	0.000000
1	D	S. aureus	4.107210
1	D	S. aureus	4.387390
1	D	S. aureus	4.477121

1	D	S. aureus	4.033424
1	D	S. aureus	4.301030
2	D	S. aureus	4.255273
2	D	S. aureus	4.414973
2	D	S. aureus	4.541579
2	D	S. aureus	4.093422
2	D	S. aureus	4.421604
2	C	S. aureus	3.719331
2	C	S. aureus	3.350248
2	C	S. aureus	3.575188
2	C	S. aureus	3.301030
2	C	S. aureus	3.421604
2	B	S. aureus	2.778151
2	B	S. aureus	2.832509
2	B	S. aureus	3.546543
2	B	S. aureus	2.602060
2	B	S. aureus	2.903090
2	A	S. aureus	2.602060
2	A	S. aureus	2.602060
2	A	S. aureus	0.602060
2	A	S. aureus	0.000000
2	A	S. aureus	1.934498
2	B	S. aureus	1.944483
2	B	S. aureus	2.832509
2	B	S. aureus	4.274158
2	B	S. aureus	2.187521
2	B	S. aureus	2.195900
2	D	S. aureus	4.283301
2	D	S. aureus	4.556303
2	D	S. aureus	4.255273
2	D	S. aureus	4.326336
2	D	S. aureus	4.695482
2	A	S. aureus	0.000000
2	A	S. aureus	0.000000
2	A	S. aureus	0.000000
2	A	S. aureus	0.000000
2	A	S. aureus	0.778151
2	C	S. aureus	3.170262
2	C	S. aureus	3.000000
2	C	S. aureus	3.146128
2	C	S. aureus	3.579784
2	C	S. aureus	3.898725
2	D	S. aureus	5.204120
2	D	S. aureus	4.832509
2	D	S. aureus	4.681241
2	D	S. aureus	4.778151
2	D	S. aureus	5.079181

2	B	S. aureus	4.204120
2	B	S. aureus	4.146128
2	B	S. aureus	3.245513
2	B	S. aureus	4.588832
2	B	S. aureus	4.235528
2	A	S. aureus	2.982271
2	A	S. aureus	3.903090
2	A	S. aureus	2.716003
2	A	S. aureus	1.845098
2	A	S. aureus	2.301030
2	C	S. aureus	3.878522
2	C	S. aureus	4.283301
2	C	S. aureus	3.494155
2	C	S. aureus	3.712650
2	C	S. aureus	3.326336
3	D	S. aureus	5.459392
3	D	S. aureus	5.380211
3	D	S. aureus	5.283301
3	D	S. aureus	5.394452
3	D	S. aureus	5.401401
3	B	S. aureus	4.987666
3	B	S. aureus	5.551450
3	B	S. aureus	5.301030
3	B	S. aureus	5.408240
3	B	S. aureus	5.214844
3	A	S. aureus	3.334454
3	A	S. aureus	3.903090
3	A	S. aureus	1.518514
3	A	S. aureus	1.838849
3	A	S. aureus	3.342423
3	C	S. aureus	4.103119
3	C	S. aureus	3.824776
3	C	S. aureus	3.494155
3	C	S. aureus	3.421604
3	C	S. aureus	4.214844
3	D	S. aureus	4.850033
3	D	S. aureus	4.930440
3	D	S. aureus	5.039811
3	D	S. aureus	4.789581
3	D	S. aureus	4.989450
3	A	S. aureus	0.000000
3	A	S. aureus	0.000000
3	A	S. aureus	0.000000
3	A	S. aureus	3.301030
3	A	S. aureus	3.079181
3	B	S. aureus	3.681241
3	B	S. aureus	4.264818

3	B	S. aureus	4.428135
3	B	S. aureus	4.459392
3	B	S. aureus	4.350248
3	C	S. aureus	4.204120
3	C	S. aureus	4.000000
3	C	S. aureus	3.800717
3	C	S. aureus	4.235528
3	C	S. aureus	4.193125
3	A	S. aureus	0.000000
3	A	S. aureus	2.380211
3	A	S. aureus	1.462398
3	A	S. aureus	1.672098
3	A	S. aureus	1.000000
3	D	S. aureus	4.905256
3	D	S. aureus	4.920123
3	D	S. aureus	4.658965
3	D	S. aureus	4.835056
3	D	S. aureus	4.959995
3	C	S. aureus	3.824776
3	C	S. aureus	3.735599
3	C	S. aureus	3.387390
3	C	S. aureus	3.181844
3	C	S. aureus	3.928396
3	B	S. aureus	3.772322
3	B	S. aureus	3.666518
3	B	S. aureus	3.181844
3	B	S. aureus	3.778151
3	B	S. aureus	1.146128
4	C	S. aureus	3.924279
4	C	S. aureus	3.924279
4	C	S. aureus	4.204120
4	C	S. aureus	4.193125
4	C	S. aureus	3.963788
4	B	S. aureus	4.000000
4	B	S. aureus	3.684845
4	B	S. aureus	3.775246
4	B	S. aureus	3.274158
4	B	S. aureus	4.326336
4	D	S. aureus	4.982271
4	D	S. aureus	5.274158
4	D	S. aureus	5.414973
4	D	S. aureus	5.655138
4	D	S. aureus	5.017033
4	A	S. aureus	0.000000
4	A	S. aureus	0.000000
4	A	S. aureus	0.000000
4	A	S. aureus	0.000000

4	A	S. aureus	0.000000
4	D	S. aureus	5.440909
4	D	S. aureus	5.158362
4	D	S. aureus	5.482874
4	D	S. aureus	5.515874
4	D	S. aureus	5.647383
4	A	S. aureus	0.301030
4	A	S. aureus	0.000000
4	A	S. aureus	0.602060
4	A	S. aureus	0.000000
4	A	S. aureus	0.000000
4	B	S. aureus	3.482874
4	B	S. aureus	3.334454
4	B	S. aureus	3.847573
4	B	S. aureus	3.477121
4	B	S. aureus	3.494155
4	C	S. aureus	3.769377
4	C	S. aureus	4.093422
4	C	S. aureus	4.017033
4	C	S. aureus	4.342423
4	C	S. aureus	4.342423
4	D	S. aureus	5.225309
4	D	S. aureus	5.000000
4	D	S. aureus	4.551450
4	D	S. aureus	4.735599
4	D	S. aureus	5.193125
4	B	S. aureus	3.428135
4	B	S. aureus	3.079181
4	B	S. aureus	3.763428
4	B	S. aureus	2.982271
4	B	S. aureus	3.614897
4	A	S. aureus	0.000000
4	A	S. aureus	0.000000
4	A	S. aureus	0.000000
4	A	S. aureus	0.000000
4	A	S. aureus	0.000000
4	C	S. aureus	3.670246
4	C	S. aureus	2.681241
4	C	S. aureus	3.357935
4	C	S. aureus	3.772322
4	C	S. aureus	3.521138
5	B	S. aureus	3.536558
5	B	S. aureus	2.152288
5	B	S. aureus	2.681241
5	B	S. aureus	3.372912
5	B	S. aureus	2.505150
5	D	S. aureus	5.357935

5	D	S. aureus	5.309630
5	D	S. aureus	5.274158
5	D	S. aureus	5.488551
5	D	S. aureus	5.214844
5	A	S. aureus	0.000000
5	A	S. aureus	1.380211
5	A	S. aureus	3.903090
5	A	S. aureus	0.000000
5	A	S. aureus	0.000000
5	C	S. aureus	2.903090
5	C	S. aureus	1.672098
5	C	S. aureus	1.973128
5	C	S. aureus	3.309630
5	C	S. aureus	3.017033
5	A	S. aureus	0.000000
5	A	S. aureus	3.017033
5	A	S. aureus	3.729165
5	A	S. aureus	0.301030
5	A	S. aureus	0.000000
5	D	S. aureus	4.709270
5	D	S. aureus	4.816904
5	D	S. aureus	4.864511
5	D	S. aureus	4.643453
5	D	S. aureus	4.691965
5	C	S. aureus	1.579784
5	C	S. aureus	1.079181
5	C	S. aureus	1.857332
5	C	S. aureus	1.568202
5	C	S. aureus	3.093422
5	B	S. aureus	3.000000
5	B	S. aureus	3.064458
5	B	S. aureus	2.924279
5	B	S. aureus	1.681241
5	B	S. aureus	2.079181
5	B	S. aureus	3.575188
5	B	S. aureus	3.482874
5	B	S. aureus	4.193125
5	B	S. aureus	3.725912
5	B	S. aureus	3.909556
5	C	S. aureus	2.903090
5	C	S. aureus	2.681241
5	C	S. aureus	2.748188
5	C	S. aureus	3.000000
5	C	S. aureus	3.380211
5	A	S. aureus	0.301030
5	A	S. aureus	0.000000
5	A	S. aureus	0.000000

5	A	S. aureus	0.000000
5	A	S. aureus	0.000000
5	D	S. aureus	4.775246
5	D	S. aureus	4.515874
5	D	S. aureus	4.531479
5	D	S. aureus	4.365488
5	D	S. aureus	4.465383
6	B	S. aureus	3.655138
6	B	S. aureus	3.556303
6	B	S. aureus	3.326336
6	B	S. aureus	3.541579
6	B	S. aureus	3.235528
6	C	S. aureus	3.158362
6	C	S. aureus	3.394452
6	C	S. aureus	2.944483
6	C	S. aureus	2.342423
6	C	S. aureus	2.204120
6	A	S. aureus	0.000000
6	A	S. aureus	0.000000
6	A	S. aureus	1.851258
6	A	S. aureus	0.000000
6	A	S. aureus	0.000000
6	D	S. aureus	4.606381
6	D	S. aureus	4.900913
6	D	S. aureus	4.610660
6	D	S. aureus	4.614897
6	D	S. aureus	4.915927
6	A	S. aureus	2.681241
6	A	S. aureus	0.000000
6	A	S. aureus	3.334454
6	A	S. aureus	0.000000
6	A	S. aureus	1.041393
6	D	S. aureus	4.814248
6	D	S. aureus	4.670246
6	D	S. aureus	4.873902
6	D	S. aureus	4.635484
6	D	S. aureus	4.597695
6	C	S. aureus	3.709270
6	C	S. aureus	4.283301
6	C	S. aureus	3.521138
6	C	S. aureus	3.181844
6	C	S. aureus	3.541579
6	B	S. aureus	4.245513
6	B	S. aureus	4.064458
6	B	S. aureus	4.133539
6	B	S. aureus	4.459392
6	B	S. aureus	4.732394

6	C	S. aureus	3.719331
6	C	S. aureus	3.453318
6	C	S. aureus	3.214844
6	C	S. aureus	4.387390
6	C	S. aureus	3.477121
6	D	S. aureus	4.763428
6	D	S. aureus	4.705864
6	D	S. aureus	4.907411
6	D	S. aureus	4.477121
6	D	S. aureus	4.741939
6	A	S. aureus	0.000000
6	A	S. aureus	1.612784
6	A	S. aureus	1.204120
6	A	S. aureus	0.301030
6	A	S. aureus	0.000000
6	B	S. aureus	2.982271
6	B	S. aureus	3.565848
6	B	S. aureus	4.264818
6	B	S. aureus	2.944483
6	B	S. aureus	3.365488

Log Reduction of Treated Carriers			
Lab	Test Chemical	Organism	Log Reduction per Carrier
1	B	P. aeruginosa	2.030007
1	B	P. aeruginosa	2.101071
1	B	P. aeruginosa	1.701205
1	B	P. aeruginosa	1.772012
1	B	P. aeruginosa	2.776560
1	C	P. aeruginosa	3.432064
1	C	P. aeruginosa	3.110831
1	C	P. aeruginosa	2.873470
1	C	P. aeruginosa	4.335154
1	C	P. aeruginosa	3.110831
1	A	P. aeruginosa	6.302124
1	A	P. aeruginosa	6.302124
1	A	P. aeruginosa	6.302124
1	A	P. aeruginosa	6.302124
1	A	P. aeruginosa	6.302124
1	D	P. aeruginosa	2.018823
1	D	P. aeruginosa	1.750674
1	D	P. aeruginosa	1.914734
1	D	P. aeruginosa	1.646985
1	D	P. aeruginosa	1.836741
1	C	P. aeruginosa	4.289429
1	C	P. aeruginosa	4.354931
1	C	P. aeruginosa	3.511278
1	C	P. aeruginosa	4.599233
1	C	P. aeruginosa	3.006128
1	D	P. aeruginosa	2.210248
1	D	P. aeruginosa	2.043917
1	D	P. aeruginosa	1.931494
1	D	P. aeruginosa	2.024611
1	D	P. aeruginosa	1.909218
1	A	P. aeruginosa	6.348810
1	A	P. aeruginosa	4.857448
1	A	P. aeruginosa	6.348810
1	A	P. aeruginosa	6.348810
1	A	P. aeruginosa	6.348810
1	B	P. aeruginosa	3.705357
1	B	P. aeruginosa	3.705357
1	B	P. aeruginosa	3.792507
1	B	P. aeruginosa	3.968599
1	B	P. aeruginosa	3.542630
1	B	P. aeruginosa	3.328811
1	B	P. aeruginosa	3.659804
1	B	P. aeruginosa	4.399392
1	B	P. aeruginosa	4.527179

1	B	P. aeruginosa	4.065570
1	C	P. aeruginosa	3.425721
1	C	P. aeruginosa	3.726751
1	C	P. aeruginosa	4.659804
1	C	P. aeruginosa	2.596417
1	C	P. aeruginosa	3.601812
1	A	P. aeruginosa	6.057347
1	A	P. aeruginosa	6.057347
1	A	P. aeruginosa	6.057347
1	A	P. aeruginosa	6.057347
1	A	P. aeruginosa	6.057347
1	D	P. aeruginosa	2.133068
1	D	P. aeruginosa	1.756317
1	D	P. aeruginosa	2.309159
1	D	P. aeruginosa	2.154257
1	D	P. aeruginosa	1.898985
2	B	P. aeruginosa	2.472328
2	B	P. aeruginosa	3.345223
2	B	P. aeruginosa	3.200486
2	B	P. aeruginosa	2.967178
2	B	P. aeruginosa	3.310960
2	A	P. aeruginosa	5.472328
2	A	P. aeruginosa	4.326200
2	A	P. aeruginosa	5.472328
2	A	P. aeruginosa	5.472328
2	A	P. aeruginosa	5.472328
2	D	P. aeruginosa	1.777583
2	D	P. aeruginosa	2.289467
2	D	P. aeruginosa	2.078613
2	D	P. aeruginosa	1.661078
2	D	P. aeruginosa	2.347458
2	C	P. aeruginosa	2.400165
2	C	P. aeruginosa	2.347458
2	C	P. aeruginosa	1.975073
2	C	P. aeruginosa	1.850134
2	C	P. aeruginosa	2.476553
2	C	P. aeruginosa	1.096052
2	C	P. aeruginosa	1.834530
2	C	P. aeruginosa	2.169978
2	C	P. aeruginosa	1.290462
2	C	P. aeruginosa	2.432474
2	B	P. aeruginosa	2.305491
2	B	P. aeruginosa	1.625271
2	B	P. aeruginosa	0.776538
2	B	P. aeruginosa	1.758810
2	B	P. aeruginosa	1.453458
2	D	P. aeruginosa	1.638074

2	D	P. aeruginosa	2.698772
2	D	P. aeruginosa	2.698772
2	D	P. aeruginosa	2.045560
2	D	P. aeruginosa	1.443500
2	A	P. aeruginosa	5.601862
2	A	P. aeruginosa	5.601862
2	A	P. aeruginosa	5.601862
2	A	P. aeruginosa	5.601862
2	A	P. aeruginosa	2.397742
2	D	P. aeruginosa	1.403657
2	D	P. aeruginosa	1.563358
2	D	P. aeruginosa	1.185162
2	D	P. aeruginosa	1.420691
2	D	P. aeruginosa	1.262328
2	C	P. aeruginosa	1.227566
2	C	P. aeruginosa	1.681910
2	C	P. aeruginosa	0.899553
2	C	P. aeruginosa	2.185162
2	C	P. aeruginosa	1.889212
2	B	P. aeruginosa	2.643011
2	B	P. aeruginosa	2.192219
2	B	P. aeruginosa	3.361577
2	B	P. aeruginosa	4.024502
2	B	P. aeruginosa	2.299429
2	A	P. aeruginosa	3.044156
2	A	P. aeruginosa	2.174490
2	A	P. aeruginosa	2.174490
2	A	P. aeruginosa	6.077580
2	A	P. aeruginosa	3.776550
3	C	P. aeruginosa	2.183835
3	C	P. aeruginosa	1.489586
3	C	P. aeruginosa	1.662132
3	C	P. aeruginosa	1.854410
3	C	P. aeruginosa	2.274916
3	A	P. aeruginosa	2.011674
3	A	P. aeruginosa	2.547917
3	A	P. aeruginosa	3.308774
3	A	P. aeruginosa	2.354097
3	A	P. aeruginosa	1.783554
3	B	P. aeruginosa	1.712289
3	B	P. aeruginosa	0.911861
3	B	P. aeruginosa	1.125741
3	B	P. aeruginosa	1.354221
3	B	P. aeruginosa	1.106436
3	D	P. aeruginosa	1.991043
3	D	P. aeruginosa	1.277832
3	D	P. aeruginosa	0.814951

3	D	P. aeruginosa	1.446975
3	D	P. aeruginosa	1.264044
3	D	P. aeruginosa	1.225673
3	D	P. aeruginosa	1.488915
3	D	P. aeruginosa	1.693035
3	D	P. aeruginosa	1.546907
3	D	P. aeruginosa	1.665006
3	A	P. aeruginosa	4.772216
3	A	P. aeruginosa	3.891402
3	A	P. aeruginosa	3.619928
3	A	P. aeruginosa	2.300924
3	A	P. aeruginosa	5.471186
3	C	P. aeruginosa	3.191689
3	C	P. aeruginosa	4.854446
3	C	P. aeruginosa	4.502264
3	C	P. aeruginosa	3.062055
3	C	P. aeruginosa	4.126093
3	B	P. aeruginosa	1.413537
3	B	P. aeruginosa	1.401128
3	B	P. aeruginosa	0.997114
3	B	P. aeruginosa	1.346590
3	B	P. aeruginosa	1.604026
3	B	P. aeruginosa	1.689705
3	B	P. aeruginosa	1.637317
3	B	P. aeruginosa	1.331380
3	B	P. aeruginosa	1.307642
3	B	P. aeruginosa	1.255464
3	C	P. aeruginosa	1.509918
3	C	P. aeruginosa	1.952390
3	C	P. aeruginosa	1.979740
3	C	P. aeruginosa	3.558547
3	C	P. aeruginosa	1.749291
3	A	P. aeruginosa	2.401469
3	A	P. aeruginosa	1.950677
3	A	P. aeruginosa	1.988465
3	A	P. aeruginosa	1.745427
3	A	P. aeruginosa	4.388880
3	D	P. aeruginosa	1.113404
3	D	P. aeruginosa	1.485790
3	D	P. aeruginosa	0.793069
3	D	P. aeruginosa	1.008669
3	D	P. aeruginosa	1.455827
4	A	P. aeruginosa	5.606441
4	A	P. aeruginosa	5.606441
4	A	P. aeruginosa	5.606441
4	A	P. aeruginosa	5.606441
4	A	P. aeruginosa	5.606441

4	B	P. aeruginosa	2.749108
4	B	P. aeruginosa	3.004381
4	B	P. aeruginosa	2.828289
4	B	P. aeruginosa	2.890437
4	B	P. aeruginosa	2.000059
4	C	P. aeruginosa	4.072146
4	C	P. aeruginosa	2.901449
4	C	P. aeruginosa	4.026388
4	C	P. aeruginosa	2.755321
4	C	P. aeruginosa	2.860057
4	D	P. aeruginosa	1.116119
4	D	P. aeruginosa	1.439051
4	D	P. aeruginosa	1.424328
4	D	P. aeruginosa	0.797646
4	D	P. aeruginosa	1.579230
4	D	P. aeruginosa	1.312305
4	D	P. aeruginosa	0.891911
4	D	P. aeruginosa	0.938043
4	D	P. aeruginosa	1.078221
4	D	P. aeruginosa	1.116010
4	B	P. aeruginosa	3.000767
4	B	P. aeruginosa	2.155669
4	B	P. aeruginosa	2.137444
4	B	P. aeruginosa	2.046524
4	B	P. aeruginosa	3.301797
4	C	P. aeruginosa	2.209008
4	C	P. aeruginosa	1.983699
4	C	P. aeruginosa	1.953736
4	C	P. aeruginosa	2.159790
4	C	P. aeruginosa	1.988900
4	A	P. aeruginosa	4.231285
4	A	P. aeruginosa	4.510038
4	A	P. aeruginosa	3.634977
4	A	P. aeruginosa	5.032917
4	A	P. aeruginosa	5.510038
4	D	P. aeruginosa	1.169052
4	D	P. aeruginosa	1.231200
4	D	P. aeruginosa	1.132068
4	D	P. aeruginosa	1.188796
4	D	P. aeruginosa	1.047748
4	C	P. aeruginosa	2.442053
4	C	P. aeruginosa	2.254063
4	C	P. aeruginosa	2.631933
4	C	P. aeruginosa	2.242481
4	C	P. aeruginosa	2.375106
4	A	P. aeruginosa	5.793654
4	A	P. aeruginosa	5.191594

4	A	P. aeruginosa	5.793654
4	A	P. aeruginosa	5.793654
4	A	P. aeruginosa	5.793654
4	B	P. aeruginosa	3.237351
4	B	P. aeruginosa	2.890564
4	B	P. aeruginosa	2.686444
4	B	P. aeruginosa	3.150201
4	B	P. aeruginosa	3.413442
5	C	P. aeruginosa	4.345353
5	C	P. aeruginosa	3.558602
5	C	P. aeruginosa	4.175091
5	C	P. aeruginosa	5.141233
5	C	P. aeruginosa	3.186991
5	B	P. aeruginosa	4.898195
5	B	P. aeruginosa	4.840203
5	B	P. aeruginosa	5.743293
5	B	P. aeruginosa	2.099840
5	B	P. aeruginosa	3.462260
5	A	P. aeruginosa	5.703815
5	A	P. aeruginosa	3.505158
5	A	P. aeruginosa	5.402785
5	A	P. aeruginosa	3.795330
5	A	P. aeruginosa	3.198665
5	D	P. aeruginosa	2.256657
5	D	P. aeruginosa	1.624634
5	D	P. aeruginosa	1.759332
5	D	P. aeruginosa	1.925664
5	D	P. aeruginosa	2.022574
5	B	P. aeruginosa	1.845790
5	B	P. aeruginosa	2.762244
5	B	P. aeruginosa	2.531795
5	B	P. aeruginosa	4.687610
5	B	P. aeruginosa	4.012121
5	A	P. aeruginosa	5.966364
5	A	P. aeruginosa	2.984093
5	A	P. aeruginosa	5.966364
5	A	P. aeruginosa	5.966364
5	A	P. aeruginosa	3.586153
5	A	P. aeruginosa	5.845058
5	A	P. aeruginosa	2.535427
5	A	P. aeruginosa	5.544028
5	A	P. aeruginosa	4.059728
5	A	P. aeruginosa	2.811634
5	D	P. aeruginosa	2.066906
5	D	P. aeruginosa	2.038878
5	D	P. aeruginosa	1.920778
5	D	P. aeruginosa	2.129054

5	D	P. aeruginosa	1.920778
5	D	P. aeruginosa	2.191631
5	D	P. aeruginosa	1.961182
5	D	P. aeruginosa	2.015539
5	D	P. aeruginosa	1.700269
5	D	P. aeruginosa	2.150238
5	C	P. aeruginosa	5.793691
5	C	P. aeruginosa	5.191631
5	C	P. aeruginosa	5.793691
5	C	P. aeruginosa	5.793691
5	C	P. aeruginosa	5.793691
5	B	P. aeruginosa	2.901574
5	B	P. aeruginosa	2.105694
5	B	P. aeruginosa	4.051336
5	B	P. aeruginosa	2.776635
5	B	P. aeruginosa	2.582815
5	C	P. aeruginosa	5.582815
5	C	P. aeruginosa	5.582815
5	C	P. aeruginosa	5.582815
5	C	P. aeruginosa	4.737717
5	C	P. aeruginosa	4.980755
6	A	P. aeruginosa	4.080408
6	A	P. aeruginosa	2.700196
6	A	P. aeruginosa	5.983498
6	A	P. aeruginosa	5.983498
6	A	P. aeruginosa	5.983498
6	B	P. aeruginosa	2.156128
6	B	P. aeruginosa	1.328359
6	B	P. aeruginosa	1.432048
6	B	P. aeruginosa	1.682468
6	B	P. aeruginosa	1.876288
6	C	P. aeruginosa	2.841557
6	C	P. aeruginosa	2.435791
6	C	P. aeruginosa	2.609948
6	C	P. aeruginosa	1.940941
6	C	P. aeruginosa	3.254560
6	D	P. aeruginosa	1.239497
6	D	P. aeruginosa	1.420551
6	D	P. aeruginosa	1.208547
6	D	P. aeruginosa	2.037851
6	D	P. aeruginosa	1.525968
6	D	P. aeruginosa	1.495730
6	D	P. aeruginosa	1.465061
6	D	P. aeruginosa	1.151865
6	D	P. aeruginosa	1.396707
6	D	P. aeruginosa	1.829760
6	C	P. aeruginosa	2.345086

6	C	P. aeruginosa	2.583469
6	C	P. aeruginosa	2.445756
6	C	P. aeruginosa	3.029333
6	C	P. aeruginosa	3.564446
6	A	P. aeruginosa	4.245195
6	A	P. aeruginosa	5.985557
6	A	P. aeruginosa	5.985557
6	A	P. aeruginosa	5.985557
6	A	P. aeruginosa	3.041075
6	B	P. aeruginosa	2.111656
6	B	P. aeruginosa	2.577317
6	B	P. aeruginosa	2.338174
6	B	P. aeruginosa	3.179377
6	B	P. aeruginosa	2.570584
6	B	P. aeruginosa	1.983217
6	B	P. aeruginosa	2.652945
6	B	P. aeruginosa	1.295187
6	B	P. aeruginosa	2.480233
6	B	P. aeruginosa	2.546050
6	A	P. aeruginosa	5.888473
6	A	P. aeruginosa	5.411352
6	A	P. aeruginosa	5.888473
6	A	P. aeruginosa	3.827775
6	A	P. aeruginosa	5.888473
6	D	P. aeruginosa	1.465414
6	D	P. aeruginosa	1.124617
6	D	P. aeruginosa	1.389218
6	D	P. aeruginosa	1.093209
6	D	P. aeruginosa	1.715953
6	C	P. aeruginosa	1.715953
6	C	P. aeruginosa	1.851616
6	C	P. aeruginosa	2.851616
6	C	P. aeruginosa	3.049984
6	C	P. aeruginosa	2.881579
1	B	S. aureus	2.950109
1	B	S. aureus	2.976981
1	B	S. aureus	3.015611
1	B	S. aureus	2.406041
1	B	S. aureus	2.657853
1	C	S. aureus	3.036295
1	C	S. aureus	2.611653
1	C	S. aureus	2.666808
1	C	S. aureus	3.393807
1	C	S. aureus	3.444959
1	D	S. aureus	1.638239
1	D	S. aureus	2.158629
1	D	S. aureus	1.575592

1	D	S. aureus	1.689860
1	D	S. aureus	1.535380
1	A	S. aureus	5.827636
1	A	S. aureus	6.304757
1	A	S. aureus	6.304757
1	A	S. aureus	6.304757
1	A	S. aureus	6.304757
1	B	S. aureus	2.863051
1	B	S. aureus	2.920194
1	B	S. aureus	3.295010
1	B	S. aureus	3.425344
1	B	S. aureus	3.182306
1	C	S. aureus	3.550282
1	C	S. aureus	3.221224
1	C	S. aureus	2.962946
1	C	S. aureus	3.194895
1	C	S. aureus	2.986011
1	D	S. aureus	2.154438
1	D	S. aureus	2.131575
1	D	S. aureus	2.291276
1	D	S. aureus	2.324700
1	D	S. aureus	2.400421
1	A	S. aureus	6.324700
1	A	S. aureus	6.324700
1	A	S. aureus	5.479602
1	A	S. aureus	6.324700
1	A	S. aureus	5.546549
1	B	S. aureus	3.302658
1	B	S. aureus	3.452421
1	B	S. aureus	3.360650
1	B	S. aureus	3.837772
1	B	S. aureus	3.235712
1	C	S. aureus	2.919442
1	C	S. aureus	3.205748
1	C	S. aureus	2.934682
1	C	S. aureus	3.103086
1	C	S. aureus	2.890478
1	A	S. aureus	6.332264
1	A	S. aureus	6.332264
1	A	S. aureus	6.332264
1	A	S. aureus	6.332264
1	A	S. aureus	6.332264
1	D	S. aureus	2.225054
1	D	S. aureus	1.944874
1	D	S. aureus	1.855143
1	D	S. aureus	2.298840
1	D	S. aureus	2.031234

2	D	S. aureus	1.660513
2	D	S. aureus	1.500812
2	D	S. aureus	1.374206
2	D	S. aureus	1.822364
2	D	S. aureus	1.494181
2	C	S. aureus	2.196454
2	C	S. aureus	2.565537
2	C	S. aureus	2.340597
2	C	S. aureus	2.614755
2	C	S. aureus	2.494181
2	B	S. aureus	3.301030
2	B	S. aureus	3.246672
2	B	S. aureus	2.532639
2	B	S. aureus	3.477121
2	B	S. aureus	3.176091
2	A	S. aureus	3.477121
2	A	S. aureus	3.477121
2	A	S. aureus	5.477121
2	A	S. aureus	6.079181
2	A	S. aureus	4.144683
2	B	S. aureus	4.134226
2	B	S. aureus	3.246200
2	B	S. aureus	1.804551
2	B	S. aureus	3.891188
2	B	S. aureus	3.882809
2	D	S. aureus	1.795407
2	D	S. aureus	1.522406
2	D	S. aureus	1.823436
2	D	S. aureus	1.752373
2	D	S. aureus	1.383227
2	A	S. aureus	6.106776
2	A	S. aureus	6.106776
2	A	S. aureus	6.106776
2	A	S. aureus	6.106776
2	A	S. aureus	5.328625
2	C	S. aureus	2.936515
2	C	S. aureus	3.106776
2	C	S. aureus	2.960648
2	C	S. aureus	2.526993
2	C	S. aureus	2.208051
2	D	S. aureus	0.910168
2	D	S. aureus	1.281779
2	D	S. aureus	1.433047
2	D	S. aureus	1.336137
2	D	S. aureus	1.035107
2	B	S. aureus	1.910168
2	B	S. aureus	1.968160

2	B	S. aureus	2.868776
2	B	S. aureus	1.525456
2	B	S. aureus	1.878760
2	A	S. aureus	3.226277
2	A	S. aureus	2.305458
2	A	S. aureus	3.492545
2	A	S. aureus	4.363450
2	A	S. aureus	3.907518
2	C	S. aureus	2.330027
2	C	S. aureus	1.925247
2	C	S. aureus	2.714394
2	C	S. aureus	2.495899
2	C	S. aureus	2.882212
3	D	S. aureus	0.991522
3	D	S. aureus	1.070704
3	D	S. aureus	1.167614
3	D	S. aureus	1.056463
3	D	S. aureus	1.049514
3	B	S. aureus	1.463249
3	B	S. aureus	0.899465
3	B	S. aureus	1.149885
3	B	S. aureus	1.042675
3	B	S. aureus	1.236071
3	A	S. aureus	2.257942
3	A	S. aureus	1.689306
3	A	S. aureus	4.073882
3	A	S. aureus	3.753547
3	A	S. aureus	2.249973
3	C	S. aureus	1.489277
3	C	S. aureus	1.767620
3	C	S. aureus	2.098242
3	C	S. aureus	2.170792
3	C	S. aureus	1.377552
3	D	S. aureus	1.227806
3	D	S. aureus	1.147400
3	D	S. aureus	1.038029
3	D	S. aureus	1.288259
3	D	S. aureus	1.088389
3	A	S. aureus	6.077839
3	A	S. aureus	6.077839
3	A	S. aureus	6.077839
3	A	S. aureus	2.776809
3	A	S. aureus	2.998658
3	B	S. aureus	2.463301
3	B	S. aureus	1.879725
3	B	S. aureus	1.716408
3	B	S. aureus	1.685150

3	B	S. aureus	1.794295
3	C	S. aureus	1.940423
3	C	S. aureus	2.144543
3	C	S. aureus	2.343826
3	C	S. aureus	1.909014
3	C	S. aureus	1.951418
3	A	S. aureus	6.306322
3	A	S. aureus	3.926111
3	A	S. aureus	4.843924
3	A	S. aureus	4.634224
3	A	S. aureus	5.306322
3	D	S. aureus	1.401066
3	D	S. aureus	1.386199
3	D	S. aureus	1.647357
3	D	S. aureus	1.471266
3	D	S. aureus	1.346327
3	C	S. aureus	1.896247
3	C	S. aureus	1.985424
3	C	S. aureus	2.333633
3	C	S. aureus	2.539179
3	C	S. aureus	1.792627
3	B	S. aureus	1.948701
3	B	S. aureus	2.054505
3	B	S. aureus	2.539179
3	B	S. aureus	1.942872
3	B	S. aureus	4.574895
4	C	S. aureus	2.355649
4	C	S. aureus	2.355649
4	C	S. aureus	2.075808
4	C	S. aureus	2.086804
4	C	S. aureus	2.316140
4	B	S. aureus	2.279928
4	B	S. aureus	2.595083
4	B	S. aureus	2.504682
4	B	S. aureus	3.005770
4	B	S. aureus	1.953592
4	D	S. aureus	1.223002
4	D	S. aureus	0.931116
4	D	S. aureus	0.790300
4	D	S. aureus	0.550135
4	D	S. aureus	1.188240
4	A	S. aureus	6.205273
4	A	S. aureus	6.205273
4	A	S. aureus	6.205273
4	A	S. aureus	6.205273
4	A	S. aureus	6.205273
4	D	S. aureus	0.866703

4	D	S. aureus	1.149250
4	D	S. aureus	0.824739
4	D	S. aureus	0.791739
4	D	S. aureus	0.660230
4	A	S. aureus	6.006583
4	A	S. aureus	6.307613
4	A	S. aureus	5.705553
4	A	S. aureus	6.307613
4	A	S. aureus	6.307613
4	B	S. aureus	2.720065
4	B	S. aureus	2.868485
4	B	S. aureus	2.355366
4	B	S. aureus	2.725818
4	B	S. aureus	2.708784
4	C	S. aureus	2.433562
4	C	S. aureus	2.109517
4	C	S. aureus	2.185906
4	C	S. aureus	1.860516
4	C	S. aureus	1.860516
4	D	S. aureus	1.065432
4	D	S. aureus	1.290741
4	D	S. aureus	1.739291
4	D	S. aureus	1.555142
4	D	S. aureus	1.097616
4	B	S. aureus	2.862606
4	B	S. aureus	3.211560
4	B	S. aureus	2.527313
4	B	S. aureus	3.308470
4	B	S. aureus	2.675844
4	A	S. aureus	6.357265
4	A	S. aureus	6.357265
4	A	S. aureus	6.357265
4	A	S. aureus	6.357265
4	A	S. aureus	6.357265
4	C	S. aureus	2.687019
4	C	S. aureus	3.676024
4	C	S. aureus	2.999330
4	C	S. aureus	2.584943
4	C	S. aureus	2.836127
5	B	S. aureus	2.815342
5	B	S. aureus	4.199612
5	B	S. aureus	3.670659
5	B	S. aureus	2.978988
5	B	S. aureus	3.846750
5	D	S. aureus	0.993966
5	D	S. aureus	1.042270
5	D	S. aureus	1.077743

5	D	S. aureus	0.863350
5	D	S. aureus	1.137057
5	A	S. aureus	6.181442
5	A	S. aureus	4.801231
5	A	S. aureus	2.278352
5	A	S. aureus	6.181442
5	A	S. aureus	6.181442
5	C	S. aureus	3.278352
5	C	S. aureus	4.509344
5	C	S. aureus	4.208314
5	C	S. aureus	2.871812
5	C	S. aureus	3.164409
5	A	S. aureus	5.752040
5	A	S. aureus	2.735006
5	A	S. aureus	2.022875
5	A	S. aureus	5.451010
5	A	S. aureus	5.752040
5	D	S. aureus	1.042770
5	D	S. aureus	0.935136
5	D	S. aureus	0.887529
5	D	S. aureus	1.108587
5	D	S. aureus	1.060075
5	C	S. aureus	4.477023
5	C	S. aureus	4.977625
5	C	S. aureus	4.199474
5	C	S. aureus	4.488605
5	C	S. aureus	2.963385
5	B	S. aureus	3.056806
5	B	S. aureus	2.992348
5	B	S. aureus	3.132527
5	B	S. aureus	4.375565
5	B	S. aureus	3.977625
5	B	S. aureus	2.573115
5	B	S. aureus	2.665429
5	B	S. aureus	1.955178
5	B	S. aureus	2.422391
5	B	S. aureus	2.238747
5	C	S. aureus	3.245213
5	C	S. aureus	3.467062
5	C	S. aureus	3.400115
5	C	S. aureus	3.148303
5	C	S. aureus	2.768092
5	A	S. aureus	5.876828
5	A	S. aureus	6.177858
5	A	S. aureus	6.177858
5	A	S. aureus	6.177858
5	A	S. aureus	6.177858

5	D	S. aureus	1.402612
5	D	S. aureus	1.661984
5	D	S. aureus	1.646379
5	D	S. aureus	1.812370
5	D	S. aureus	1.712475
6	B	S. aureus	2.549338
6	B	S. aureus	2.648174
6	B	S. aureus	2.878141
6	B	S. aureus	2.662898
6	B	S. aureus	2.968948
6	C	S. aureus	3.046114
6	C	S. aureus	2.810025
6	C	S. aureus	3.259994
6	C	S. aureus	3.862054
6	C	S. aureus	4.000357
6	A	S. aureus	6.166782
6	A	S. aureus	6.166782
6	A	S. aureus	4.315524
6	A	S. aureus	6.166782
6	A	S. aureus	6.166782
6	D	S. aureus	1.560401
6	D	S. aureus	1.265869
6	D	S. aureus	1.556122
6	D	S. aureus	1.551885
6	D	S. aureus	1.250855
6	A	S. aureus	3.642182
6	A	S. aureus	6.323424
6	A	S. aureus	2.988970
6	A	S. aureus	6.323424
6	A	S. aureus	5.282031
6	D	S. aureus	1.509176
6	D	S. aureus	1.653178
6	D	S. aureus	1.449522
6	D	S. aureus	1.687940
6	D	S. aureus	1.725728
6	C	S. aureus	2.652620
6	C	S. aureus	2.078589
6	C	S. aureus	2.840752
6	C	S. aureus	3.180047
6	C	S. aureus	2.820311
6	B	S. aureus	2.116378
6	B	S. aureus	2.297432
6	B	S. aureus	2.228352
6	B	S. aureus	1.902498
6	B	S. aureus	1.629497
6	C	S. aureus	2.649620
6	C	S. aureus	2.915633

6	C	S. aureus	3.154107
6	C	S. aureus	1.981561
6	C	S. aureus	2.891830
6	D	S. aureus	1.605523
6	D	S. aureus	1.663088
6	D	S. aureus	1.461540
6	D	S. aureus	1.891830
6	D	S. aureus	1.627012
6	A	S. aureus	6.211295
6	A	S. aureus	4.598511
6	A	S. aureus	5.007175
6	A	S. aureus	5.910265
6	A	S. aureus	6.211295
6	B	S. aureus	3.229024
6	B	S. aureus	2.645447
6	B	S. aureus	1.946477
6	B	S. aureus	3.266812
6	B	S. aureus	2.845807

Log Density of Control Carriers			
Lab	Test Chemical	Organism	Log Density per Carrier
1	Controls	P. aeruginosa	5.735599
1	Controls	P. aeruginosa	5.684845
1	Controls	P. aeruginosa	5.662758
1	Controls	P. aeruginosa	5.775246
1	Controls	P. aeruginosa	5.789581
1	Controls	P. aeruginosa	5.684845
1	Controls	P. aeruginosa	6.120574
1	Controls	P. aeruginosa	5.698970
1	Controls	P. aeruginosa	5.575188
4	Controls	P. aeruginosa	5.670246
4	Controls	P. aeruginosa	5.428135
4	Controls	P. aeruginosa	5.477121
4	Controls	P. aeruginosa	5.751279
4	Controls	P. aeruginosa	5.631444
4	Controls	P. aeruginosa	5.658965
4	Controls	P. aeruginosa	5.709270
4	Controls	P. aeruginosa	5.536558
4	Controls	P. aeruginosa	5.570543
5	Controls	P. aeruginosa	6.133539
5	Controls	P. aeruginosa	5.606381
5	Controls	P. aeruginosa	5.778151
5	Controls	P. aeruginosa	6.357935
5	Controls	P. aeruginosa	5.982271
5	Controls	P. aeruginosa	6.158362
5	Controls	P. aeruginosa	6.283301
5	Controls	P. aeruginosa	6.033424
5	Controls	P. aeruginosa	6.093422
6	Controls	P. aeruginosa	6.181844
6	Controls	P. aeruginosa	6.350248
6	Controls	P. aeruginosa	6.181844
6	Controls	P. aeruginosa	5.766413
6	Controls	P. aeruginosa	5.681241
6	Controls	P. aeruginosa	5.783904
6	Controls	P. aeruginosa	6.120574
6	Controls	P. aeruginosa	6.120574
6	Controls	P. aeruginosa	6.120574
1	Controls	S.aureus	6.401401
1	Controls	S.aureus	6.408240
1	Controls	S.aureus	6.421604
1	Controls	S.aureus	6.421604
1	Controls	S.aureus	6.380211
1	Controls	S.aureus	6.401401
1	Controls	S.aureus	6.326336
1	Controls	S.aureus	6.342423

1	Controls	S.aureus	6.309630
4	Controls	S.aureus	5.824776
4	Controls	S.aureus	5.847573
4	Controls	S.aureus	5.847573
4	Controls	S.aureus	6.120574
4	Controls	S.aureus	6.170262
4	Controls	S.aureus	6.107210
4	Controls	S.aureus	6.064458
4	Controls	S.aureus	6.170262
4	Controls	S.aureus	6.133539
5	Controls	S.aureus	6.301030
5	Controls	S.aureus	6.204120
5	Controls	S.aureus	6.318063
5	Controls	S.aureus	6.334454
5	Controls	S.aureus	6.204120
5	Controls	S.aureus	6.274158
5	Controls	S.aureus	6.225309
5	Controls	S.aureus	6.158362
5	Controls	S.aureus	6.225309
6	Controls	S.aureus	6.170262
6	Controls	S.aureus	6.158362
6	Controls	S.aureus	6.049218
6	Controls	S.aureus	6.146128
6	Controls	S.aureus	6.283301
6	Controls	S.aureus	6.453318
6	Controls	S.aureus	6.204120
6	Controls	S.aureus	6.079181
6	Controls	S.aureus	6.193125

Quantitative Performance Evaluation of Antimicrobial Towelettes (QTM): Phase 3 Data Compilation

Log Density of Treated Carriers			
Lab	Test Chemical	Organism	Log Density per Carrier
1	E	P. aeruginosa	0.000000
1	E	P. aeruginosa	0.000000
1	E	P. aeruginosa	0.000000
1	E	P. aeruginosa	0.000000
1	E	P. aeruginosa	0.000000
1	E	P. aeruginosa	0.000000
1	E	P. aeruginosa	0.000000
1	E	P. aeruginosa	0.000000
1	E	P. aeruginosa	0.000000
1	E	P. aeruginosa	0.000000
1	E	P. aeruginosa	0.000000
1	E	P. aeruginosa	0.000000
1	E	P. aeruginosa	0.000000
1	E	P. aeruginosa	0.000000
1	E	P. aeruginosa	0.000000
4	E	P. aeruginosa	0.000000
4	E	P. aeruginosa	0.000000
4	E	P. aeruginosa	0.000000
4	E	P. aeruginosa	0.000000
4	E	P. aeruginosa	0.000000
4	E	P. aeruginosa	0.000000
4	E	P. aeruginosa	0.000000
4	E	P. aeruginosa	0.000000
4	E	P. aeruginosa	0.000000
4	E	P. aeruginosa	0.000000
4	E	P. aeruginosa	0.000000
4	E	P. aeruginosa	0.000000
4	E	P. aeruginosa	0.000000
4	E	P. aeruginosa	0.000000
4	E	P. aeruginosa	0.000000
5	E	P. aeruginosa	1.544068
5	E	P. aeruginosa	0.000000
5	E	P. aeruginosa	0.000000
5	E	P. aeruginosa	0.000000
5	E	P. aeruginosa	0.000000
5	E	P. aeruginosa	0.000000
5	E	P. aeruginosa	0.000000
5	E	P. aeruginosa	0.000000
5	E	P. aeruginosa	0.000000
5	E	P. aeruginosa	0.000000
5	E	P. aeruginosa	0.000000
5	E	P. aeruginosa	0.000000
5	E	P. aeruginosa	0.000000
5	E	P. aeruginosa	0.000000

5	E	P. aeruginosa	0.000000
6	E	P. aeruginosa	2.170262
6	E	P. aeruginosa	0.000000
6	E	P. aeruginosa	0.000000
6	E	P. aeruginosa	0.000000
6	E	P. aeruginosa	0.000000
6	E	P. aeruginosa	0.000000
6	E	P. aeruginosa	0.000000
6	E	P. aeruginosa	0.000000
6	E	P. aeruginosa	0.000000
6	E	P. aeruginosa	0.000000
6	E	P. aeruginosa	0.000000
6	E	P. aeruginosa	0.000000
6	E	P. aeruginosa	0.000000
6	E	P. aeruginosa	0.000000
1	E	S. aureus	0.000000
1	E	S. aureus	0.000000
1	E	S. aureus	0.000000
1	E	S. aureus	0.000000
1	E	S. aureus	0.000000
1	E	S. aureus	0.000000
1	E	S. aureus	0.000000
1	E	S. aureus	0.000000
1	E	S. aureus	0.000000
1	E	S. aureus	0.000000
1	E	S. aureus	0.000000
1	E	S. aureus	0.000000
1	E	S. aureus	0.000000
1	E	S. aureus	0.000000
1	E	S. aureus	0.000000
1	E	S. aureus	0.000000
4	E	S. aureus	0.000000
4	E	S. aureus	0.000000
4	E	S. aureus	0.000000
4	E	S. aureus	0.000000
4	E	S. aureus	0.000000
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4	E	S. aureus	0.000000
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4	E	S. aureus	0.000000
4	E	S. aureus	0.000000
4	E	S. aureus	0.000000
4	E	S. aureus	0.000000
4	E	S. aureus	0.000000
5	E	S. aureus	0.000000

5	E	S. aureus	0.000000
5	E	S. aureus	0.000000
5	E	S. aureus	0.000000
5	E	S. aureus	0.000000
5	E	S. aureus	0.000000
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5	E	S. aureus	0.000000
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6	E	S. aureus	0.000000
6	E	S. aureus	0.000000
6	E	S. aureus	0.000000
6	E	S. aureus	0.000000
6	E	S. aureus	0.000000
6	E	S. aureus	0.000000
6	E	S. aureus	0.000000
6	E	S. aureus	0.000000
6	E	S. aureus	0.000000
6	E	S. aureus	0.000000
6	E	S. aureus	0.000000
6	E	S. aureus	0.000000
6	E	S. aureus	0.000000
6	E	S. aureus	0.000000
6	E	S. aureus	0.000000

Log Reduction of Treated Carriers			
Lab	Test Chemical	Organism	Log Reduction per Carrier
1	E	P. aeruginosa	5.694401
1	E	P. aeruginosa	5.694401
1	E	P. aeruginosa	5.694401
1	E	P. aeruginosa	5.694401
1	E	P. aeruginosa	5.694401
1	E	P. aeruginosa	5.749891
1	E	P. aeruginosa	5.749891
1	E	P. aeruginosa	5.749891
1	E	P. aeruginosa	5.749891
1	E	P. aeruginosa	5.749891
1	E	P. aeruginosa	5.798244
1	E	P. aeruginosa	5.798244
1	E	P. aeruginosa	5.798244
1	E	P. aeruginosa	5.798244
1	E	P. aeruginosa	5.798244
4	E	P. aeruginosa	5.525167
4	E	P. aeruginosa	5.525167
4	E	P. aeruginosa	5.525167
4	E	P. aeruginosa	5.525167
4	E	P. aeruginosa	5.525167
4	E	P. aeruginosa	5.680563
4	E	P. aeruginosa	5.680563
4	E	P. aeruginosa	5.680563
4	E	P. aeruginosa	5.680563
4	E	P. aeruginosa	5.680563
4	E	P. aeruginosa	5.605457
4	E	P. aeruginosa	5.605457
4	E	P. aeruginosa	5.605457
4	E	P. aeruginosa	5.605457
4	E	P. aeruginosa	5.605457
5	E	P. aeruginosa	4.295289
5	E	P. aeruginosa	5.839357
5	E	P. aeruginosa	5.839357
5	E	P. aeruginosa	5.839357
5	E	P. aeruginosa	5.839357
5	E	P. aeruginosa	6.166190
5	E	P. aeruginosa	6.166190
5	E	P. aeruginosa	6.166190
5	E	P. aeruginosa	6.166190
5	E	P. aeruginosa	6.166190
5	E	P. aeruginosa	6.136716
5	E	P. aeruginosa	6.136716
5	E	P. aeruginosa	6.136716
5	E	P. aeruginosa	6.136716

5	E	P. aeruginosa	6.136716
6	E	P. aeruginosa	4.067717
6	E	P. aeruginosa	6.237978
6	E	P. aeruginosa	6.237978
6	E	P. aeruginosa	6.237978
6	E	P. aeruginosa	6.237978
6	E	P. aeruginosa	5.743853
6	E	P. aeruginosa	5.743853
6	E	P. aeruginosa	5.743853
6	E	P. aeruginosa	5.743853
6	E	P. aeruginosa	5.743853
6	E	P. aeruginosa	6.120574
6	E	P. aeruginosa	6.120574
6	E	P. aeruginosa	6.120574
6	E	P. aeruginosa	6.120574
6	E	P. aeruginosa	6.120574
1	E	S. aureus	6.410415
1	E	S. aureus	6.410415
1	E	S. aureus	6.410415
1	E	S. aureus	6.410415
1	E	S. aureus	6.410415
1	E	S. aureus	6.401072
1	E	S. aureus	6.401072
1	E	S. aureus	6.401072
1	E	S. aureus	6.401072
1	E	S. aureus	6.401072
1	E	S. aureus	6.326130
1	E	S. aureus	6.326130
1	E	S. aureus	6.326130
1	E	S. aureus	6.326130
1	E	S. aureus	6.326130
4	E	S. aureus	5.839974
4	E	S. aureus	5.839974
4	E	S. aureus	5.839974
4	E	S. aureus	5.839974
4	E	S. aureus	5.839974
4	E	S. aureus	6.132682
4	E	S. aureus	6.132682
4	E	S. aureus	6.132682
4	E	S. aureus	6.132682
4	E	S. aureus	6.132682
4	E	S. aureus	6.122753
4	E	S. aureus	6.122753
4	E	S. aureus	6.122753
4	E	S. aureus	6.122753
4	E	S. aureus	6.122753
5	E	S. aureus	6.274404

5	E	S. aureus	6.274404
5	E	S. aureus	6.274404
5	E	S. aureus	6.274404
5	E	S. aureus	6.274404
5	E	S. aureus	6.270911
5	E	S. aureus	6.270911
5	E	S. aureus	6.270911
5	E	S. aureus	6.270911
5	E	S. aureus	6.270911
5	E	S. aureus	6.202994
5	E	S. aureus	6.202994
5	E	S. aureus	6.202994
5	E	S. aureus	6.202994
5	E	S. aureus	6.202994
6	E	S. aureus	6.125947
6	E	S. aureus	6.125947
6	E	S. aureus	6.125947
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6	E	S. aureus	6.125947
6	E	S. aureus	6.294249
6	E	S. aureus	6.294249
6	E	S. aureus	6.294249
6	E	S. aureus	6.294249
6	E	S. aureus	6.294249
6	E	S. aureus	6.158809
6	E	S. aureus	6.158809
6	E	S. aureus	6.158809
6	E	S. aureus	6.158809
6	E	S. aureus	6.158809

FINAL:
Multi-laboratory evaluation of the quantitative towelette method test of antimicrobial efficacy against *P. aeruginosa* and *S. aureus*

(Version for Docket **#EPA-HQ-OPP-2024-0414**)

Study factors

- 6 labs, encoded as 1-6
- 2 microbes: *P. aeruginosa* and *S. aureus*
- 5 treatments:
  - Dry towelettes saturated with one of four solutions:
    - A: 2500ppm Quat
    - B: 500ppm Quat
    - C: Citric Acid (1:51 for *P.a.*, 1:21 for *S.a.*)
    - D: PBS + 0.1% Tween 80
  - Pre-saturated product provided by a collaborator
    - E: 0.38% Quat

Study overview

Original Study

- Completed between August 2022 and January 2023
- On each test day for a single microbe, two of the treatments A-D were assessed. There were 3 control carriers and 5 treated carriers per treatment for a total of 13 carriers per day.
- Each lab generated 6 test days of data for each microbe, 3 test days for each treatment, using the same technician team at each lab for the technical steps of the QTM.
- There were a total of 36 tests, 108 control carriers, 360 treated carriers per microbe.

Additional Treatment E

- Completed February-March 2024
- After the original study of treatments A-D, a highly efficacious 5th treatment E was assessed.
- Labs 1, 4, 5 and 6 generated 3 test days of data for each microbe with treatment E, using the same technician team at each lab for the technical steps of the QTM.
- For treatment E there were an additional total of 12 tests, 36 control carriers and 60 treated carriers per microbe.

Terms (see reference [1])

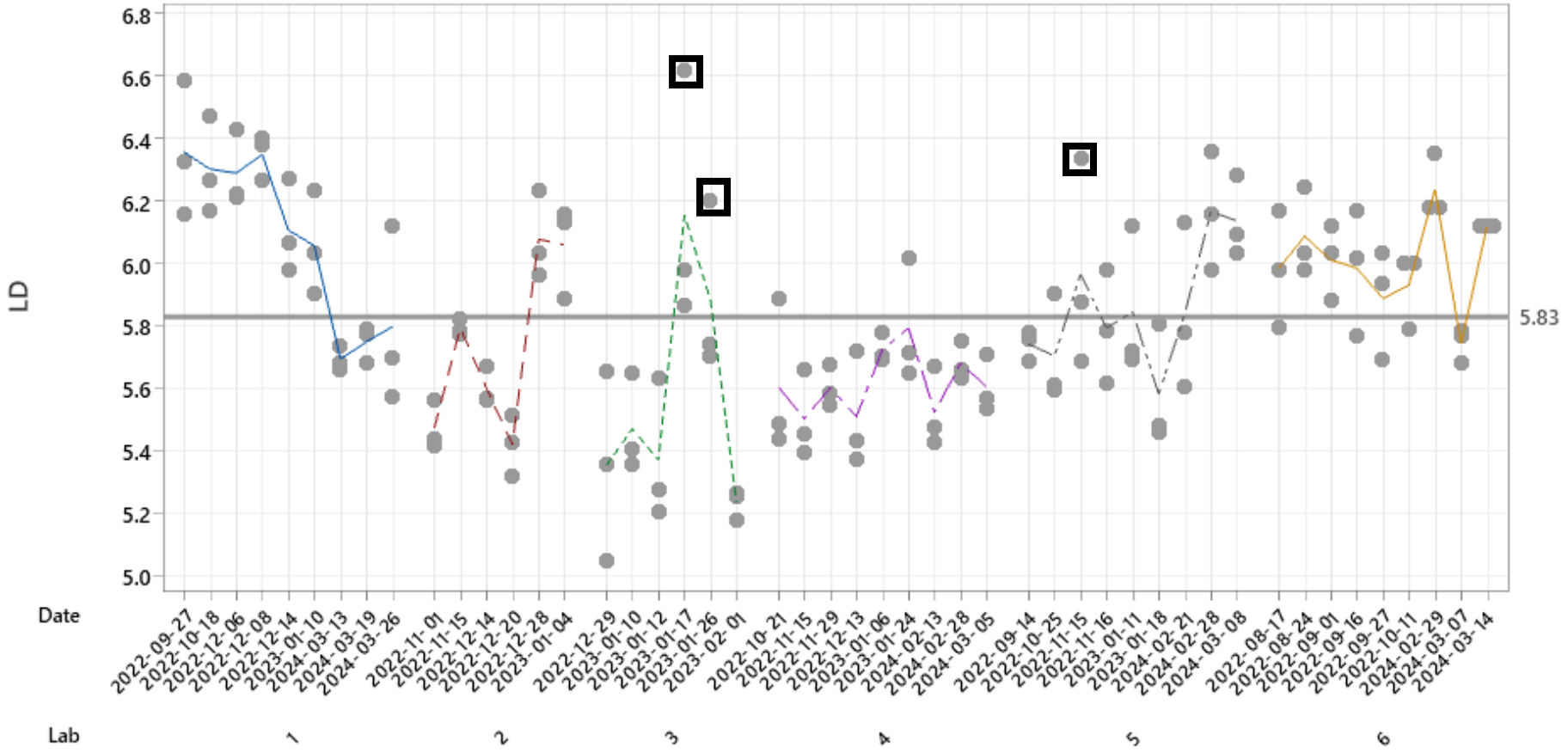
- LD: log density, $\log_{10}$(CFU/carrier)
- Control LD: $\log_{10}$(CFU/carrier) for each control sample
- Treated LD: $\log_{10}$(CFU/carrier) for each treated sample
- *TestLD*: mean of the 3 Control LDs for a single test
- LR: difference between the *TestLD* and the mean of the 5 Treated LDs from a single test
- CS_r and S_r: *repeatability* SD, within a single lab but across tests, for controls and LRs, respectively
- CS_R and S_R: *reproducibility* SD, across multiple labs and tests, for controls and LRs, respectively
- CI: confidence interval
- SE: standard error
- *p*: *p*-value

Data analysis

- LDs were calculated by a weighted average of the CFUs from multiple countable dilutions.
- To assess reproducibility and repeatability of the control LDs, a linear mixed effects model (LMM) was fit to the control LDs for each microbe separately with nested random effects for lab and test day.
- To assess reproducibility and repeatability of the LRs, an LMM was fit to the LRs (one for each test day at each lab) for each microbe and treatment separately with a random effect for lab.
- Outlier detection was conducted via individual value plots, residual versus fits plots, and normal probability plots (see reference [1]).
- Outliers were detected in the control LDs (see boxes in Figures 1 and 3), in the treated LDs (see boxes in Figures 5) and in the LRs (see boxes in Figures 7 and 8). All data were deemed valid and included in the statistical analysis.

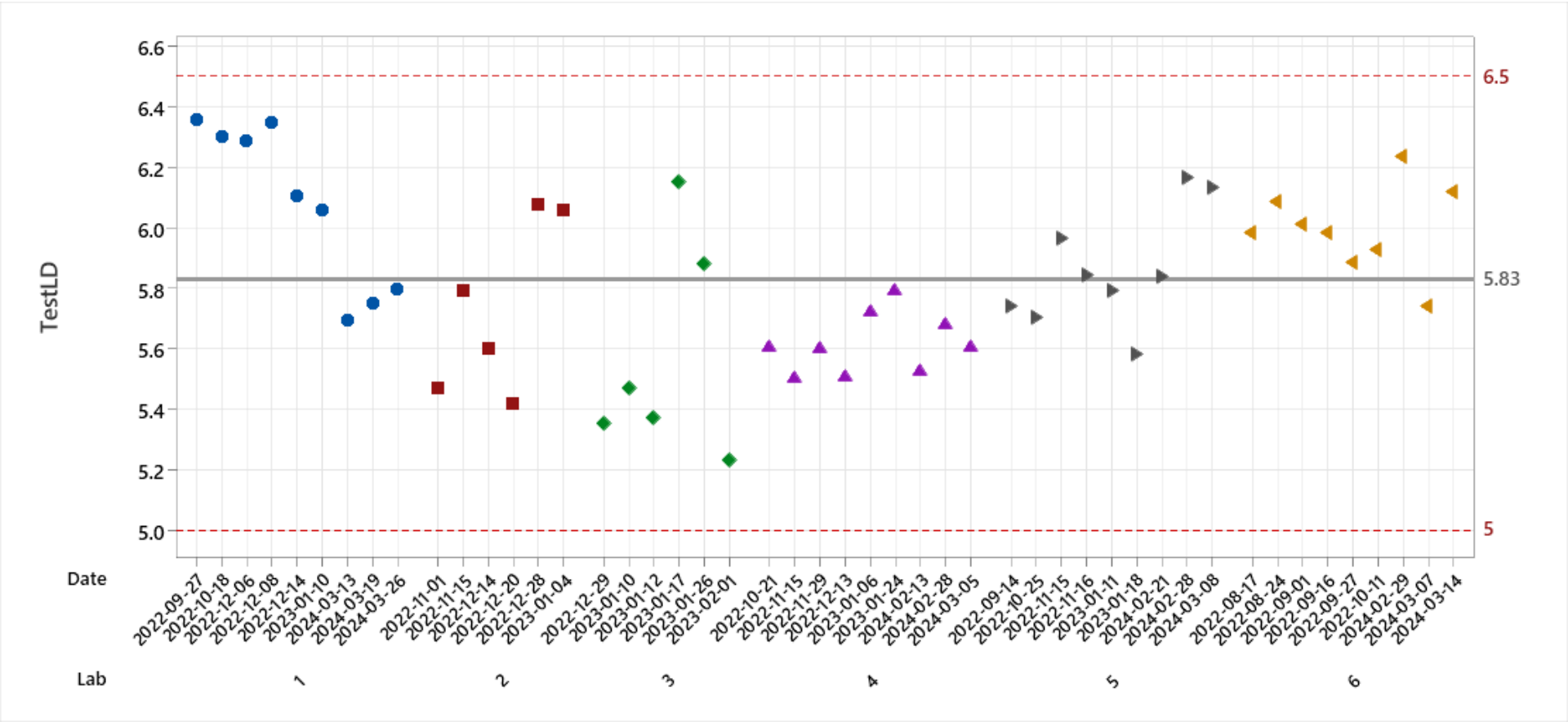
Analysis of Controls

Figure 1. *P. aeruginosa* Control LDs across labs



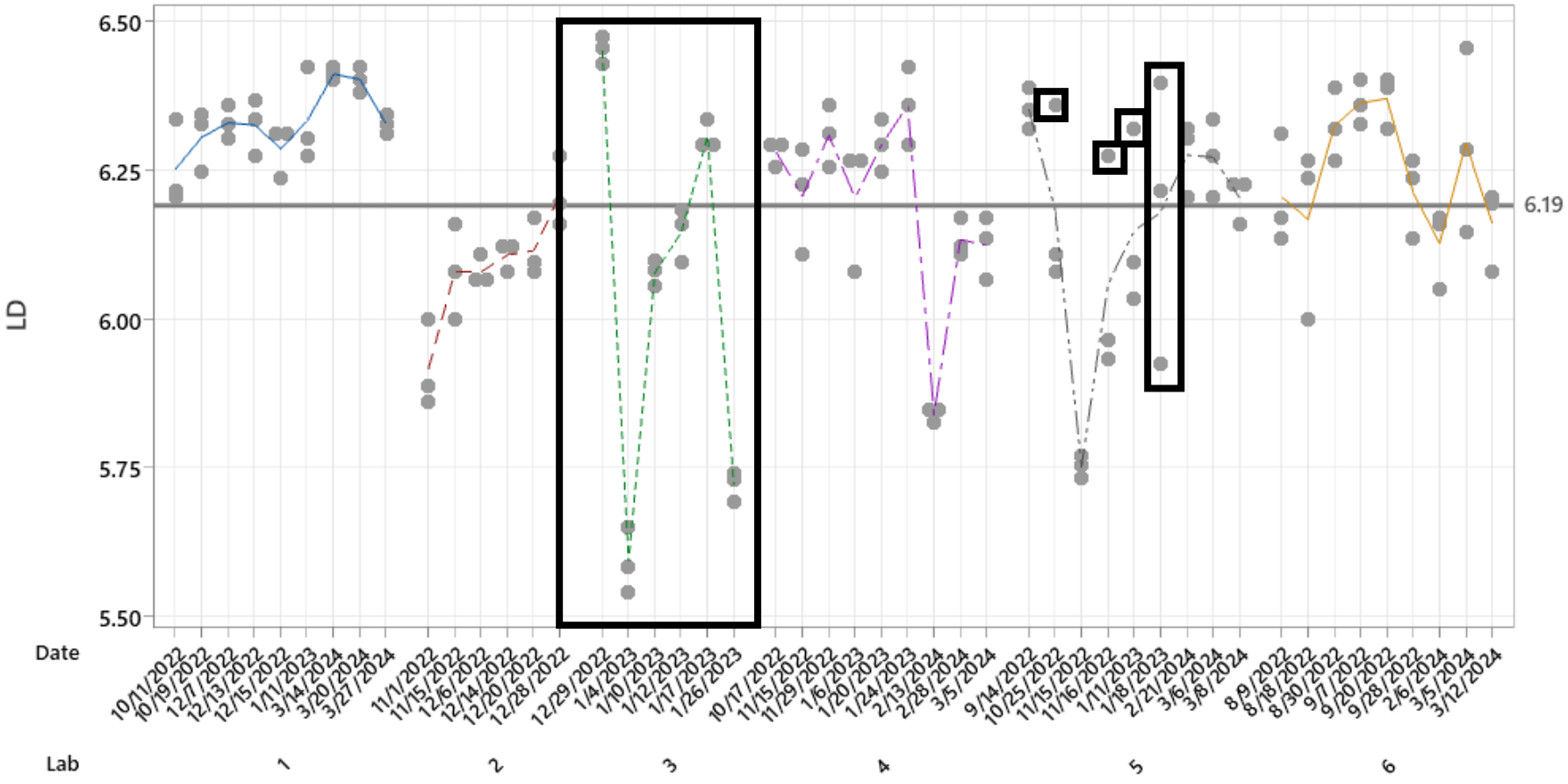
- Each point is the LD for 1 of 3 replicate control carriers on one test day from one lab.
- The colored lines for each lab indicate how the mean LD changes from test to test. There is no consistent trend across test days.
- Horizontal gray line indicates the overall mean LD across all labs and tests.
- **Boxes** indicate outliers, data were deemed valid and included in the statistical analysis.

Figure 2. *P. aeruginosa TestLDs* across labs



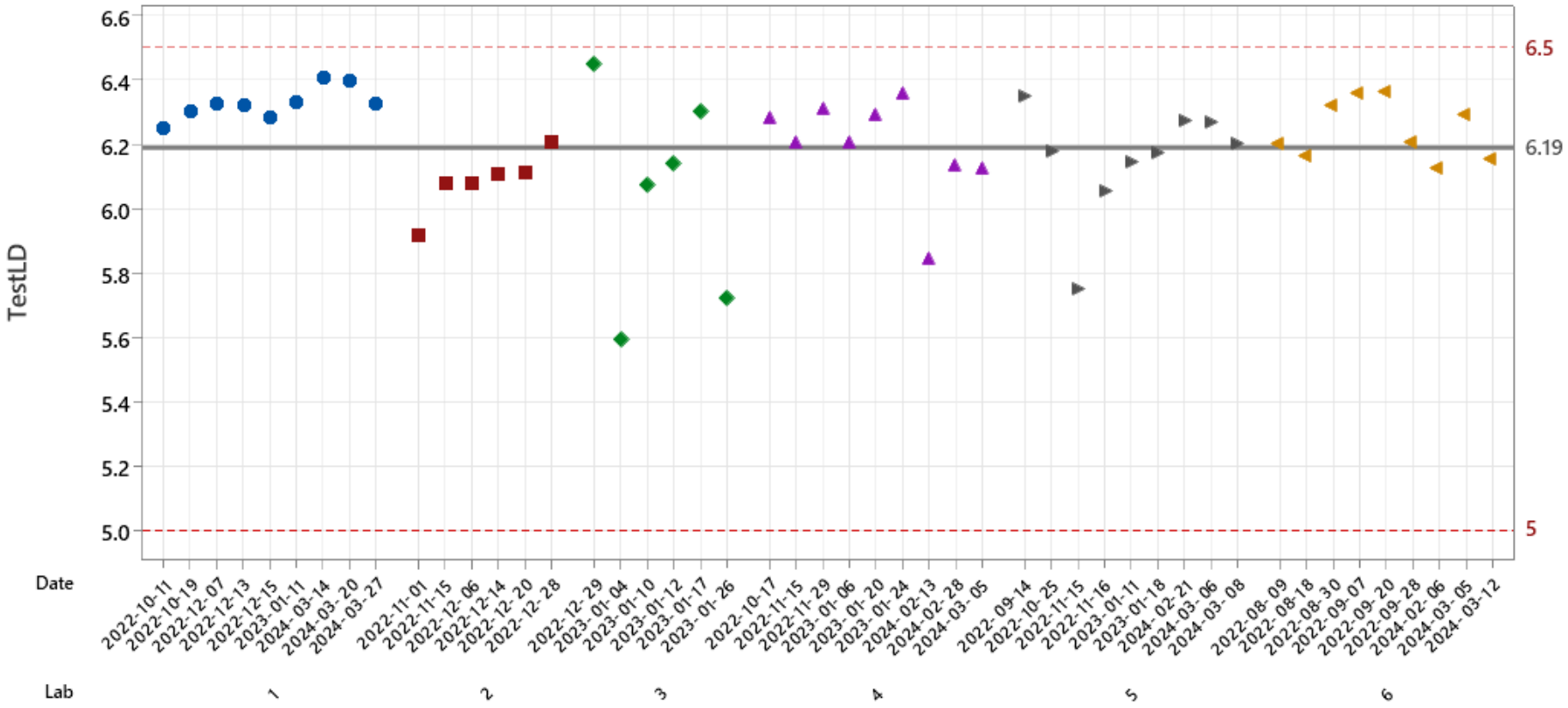
- Each point is the *TestLD* = mean of the 3 control LDs on one test day from one lab.
- Dashed red horizontal lines indicate the expected range 5.0 – 6.5 of the *TestLD*.
- Thick horizontal gray line indicates the overall mean of the Control LDs.

Figure 3. *S. aureus* Control LDs across labs



- Each point is the LD for 1 of 3 replicate control carriers on one test day from one lab.
- The colored lines for each lab indicate how the mean LD changes from test to test. There is no consistent trend across test days.
- Horizontal gray line indicates the overall mean LD across all labs and tests.
- **Boxes** indicate outliers, data were deemed valid and included in the statistical analysis. Lab 3 was identified as having the most variability compared to any other lab.

Figure 4. *S. aureus TestLDs* across labs



- Each point is the *TestLD* = mean of the 3 control LDs on one test day from one lab.
- Dashed red horizontal lines indicate the expected range 5.0 – 6.5 of the *TestLD*.
- Thick horizontal gray line indicates the overall mean of the Control LDs.

Results For Controls

Table 1. Mean and Variability of the *TestLDs*

Microbe	Num. Labs	Num. Tests	Mean LD	SEM	95% CI of Mean	CS_R	CS_r	% lab	% test	% coupon/3
P.a.	6	48	5.82	0.0833	[5.56, 6.03]	0.295	0.228	40%	48%	12%
S.a.	6	48	6.18	0.0416	[6.07, 6.29]	0.183	0.163	21%	73%	6%

The Reproducibility SD (CS_R) and Repeatability SD (CS_r) of the controls are very small, exhibiting excellent reproducibility across labs and excellent repeatability within a lab.

These SDs are predictive. For example, if a new lab with the same level of training and equipment as the 6 labs in this study ran another QTM test with *P. aeruginosa*, then the control *TestLD* in that new lab is predicted to be only 1/4 log different than the true overall mean of the *TestLDs*.

The primary contributor for variability for *Pseudomonas* is lab-to-lab, while the primary contributor for *Staphylococcus* is test-to-test.

Results For Controls

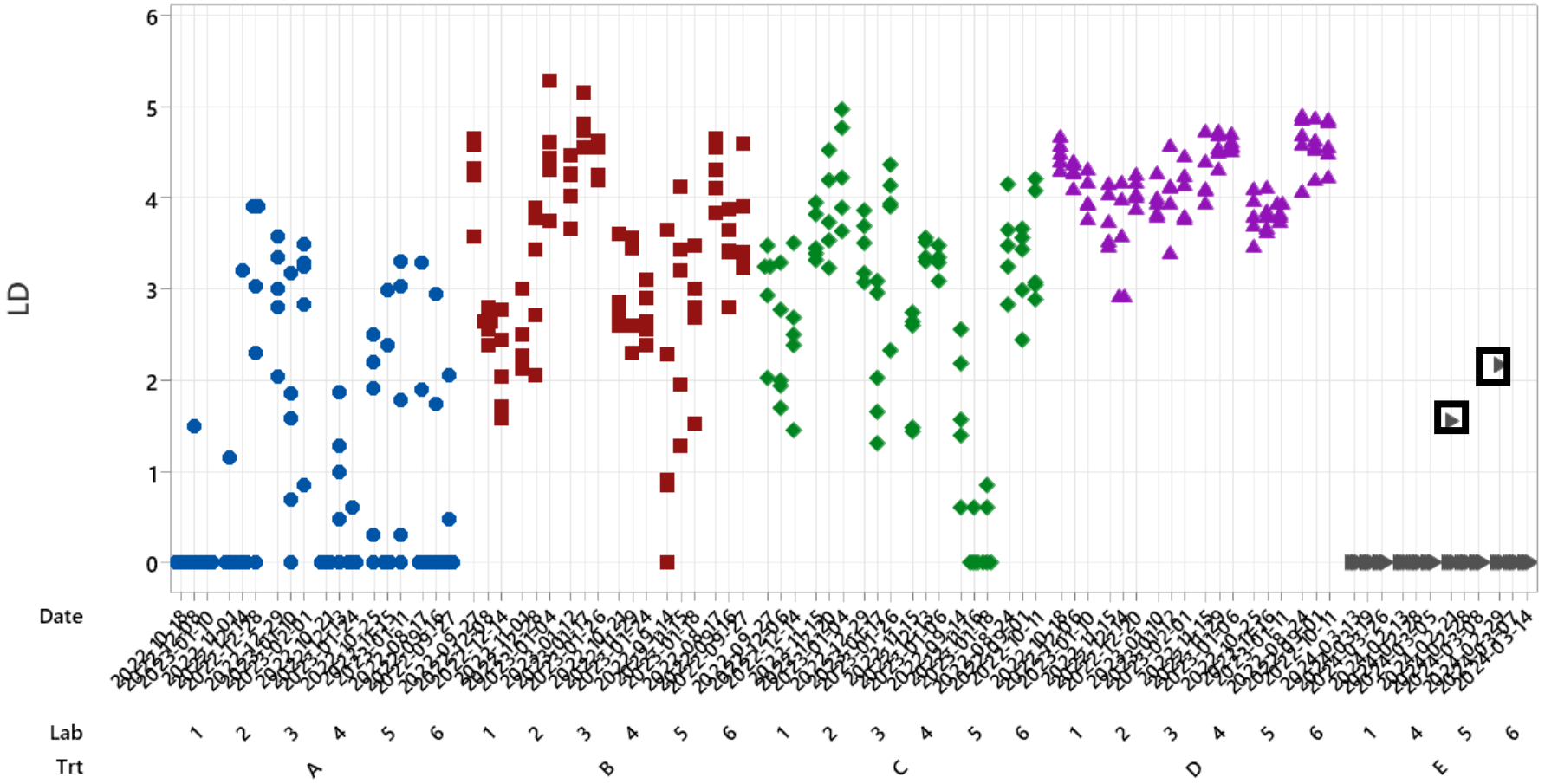
Table 2. Mean and Variability of the *TestLDs* by Study

Microbe	Study	Num. Labs	Num. Tests	Mean LD	SEM	95% CI of Mean	CS_R	CS_r	% lab	% test	% coupon/3
P.a.	A-D	6	36	5.82	0.1019	[5.56, 6.08]	0.314	0.210	56%	33%	11%
	E	4	12	5.86	0.1095	[5.51, 6.21]	0.257	0.164	59%	30%	11%
S.a.	A-D	6	36	6.18	0.0462	[6.06, 6.30]	0.204	0.183	19%	64%	17%
	E	4	12	6.21	0.0720	[5.98, 6.44]	0.165	0.099	64%	31%	5%

There is only a small variation in the mean *TestLD*, CS_R and CS_r between the two studies (Original when treatments A-D were tested, and then when Treatment E was tested)

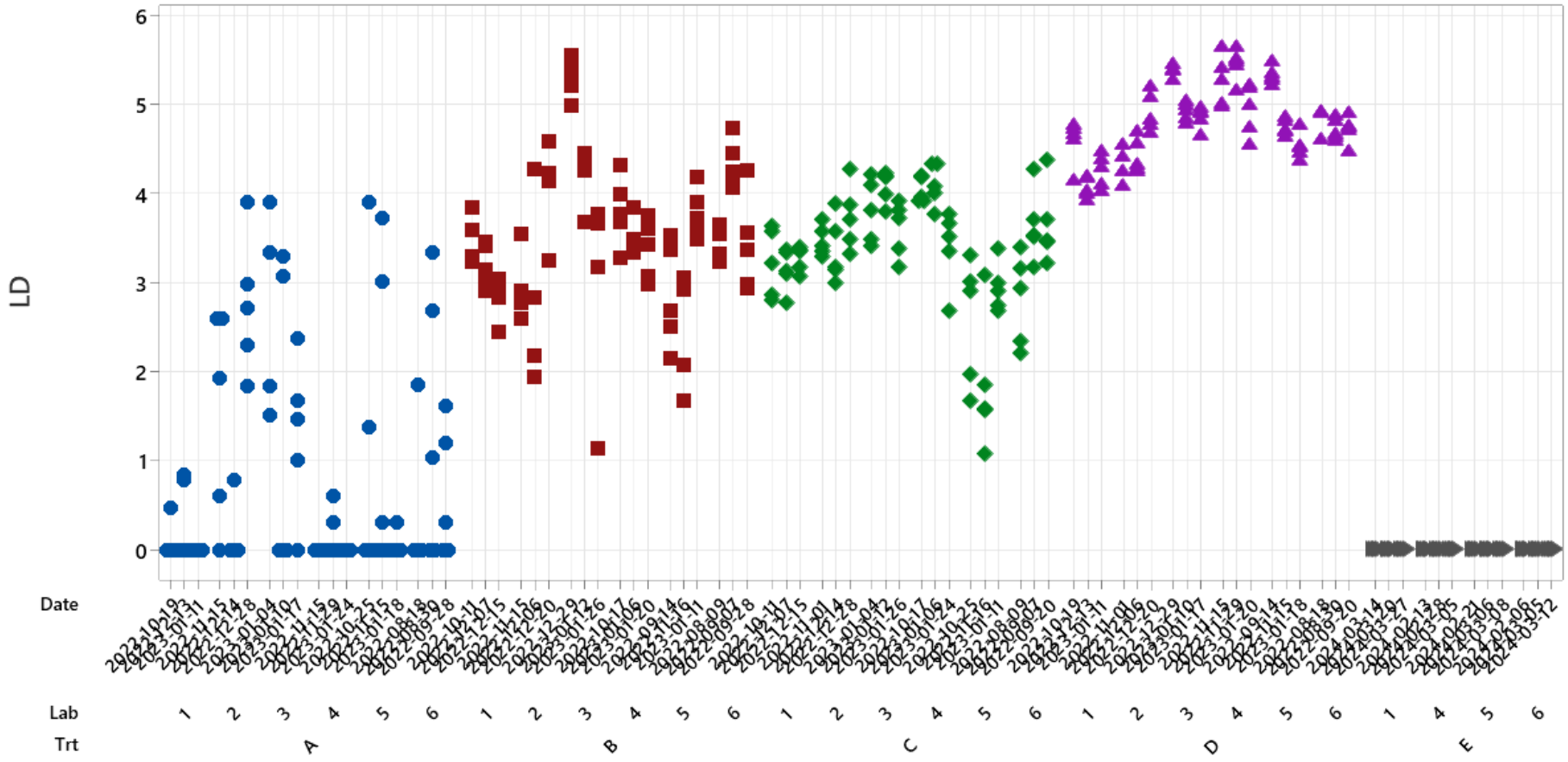
Analysis of Antimicrobial Efficacy

Figure 5. *P. aeruginosa* treated LDs across labs



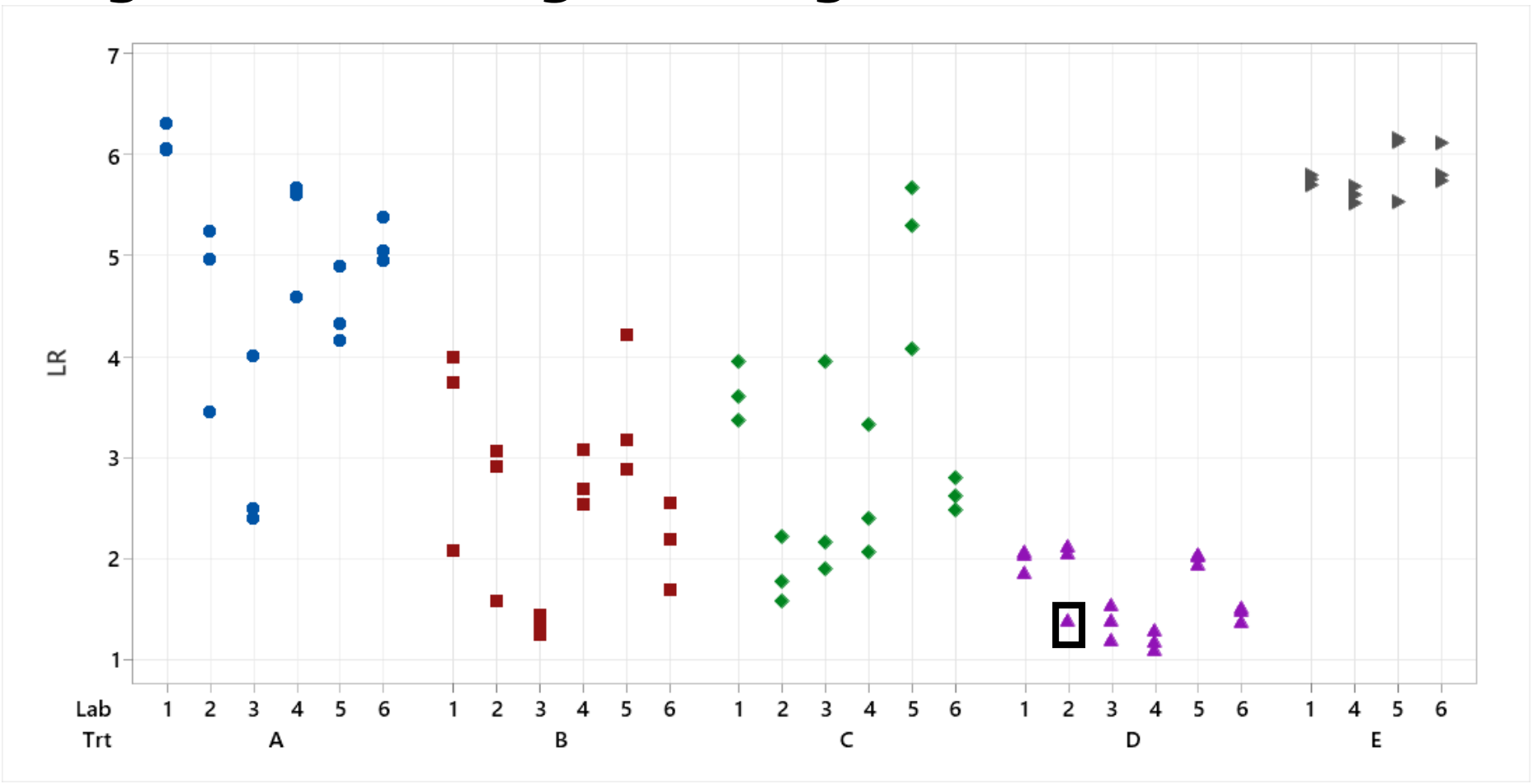
Each point is the LD for 1 of 5 replicate treated carriers from one test day from one lab. Boxes indicate outliers, data were deemed valid and included in the statistical analysis.

Figure 6. *S. aureus* treated LDs across labs



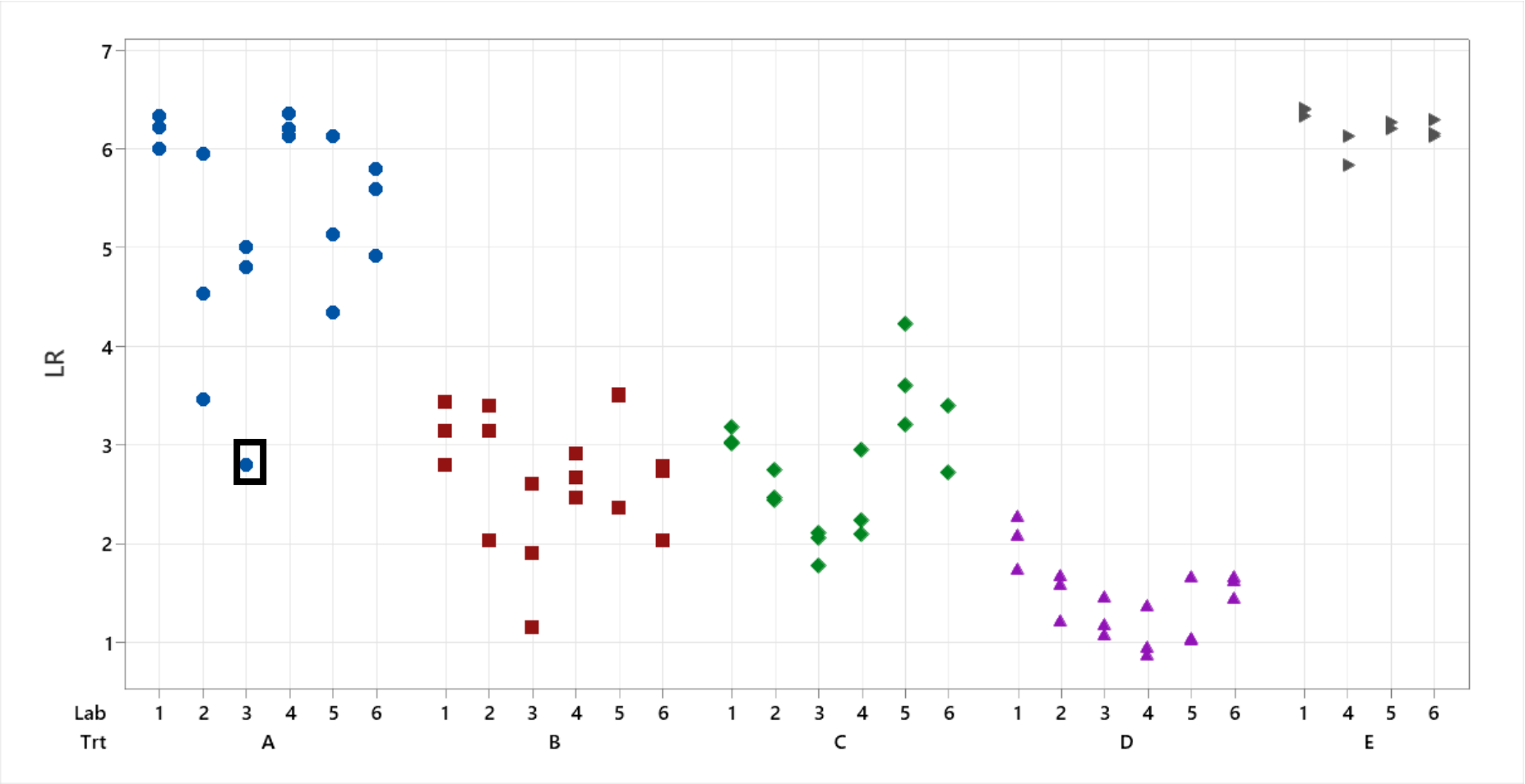
Each point is the LD for 1 of 5 replicate treated carriers from one test day from one lab.

Figure 7. *P. aeruginosa* log reductions across labs



- Each point is the LR (calculated from 3 control carriers and 5 treated carriers) for one test day for one treatment from one lab.
- Boxes indicate outliers, data were deemed valid and included in the statistical analysis.

Figure 8. *S. aureus* log reductions across labs



- Each point is the LR (calculated from 3 control carriers and 5 treated carriers) for one test day for one treatment from one lab.
- Box indicates an outlier, data were deemed valid and included in the statistical analysis.

Results for LR (1 of 3)

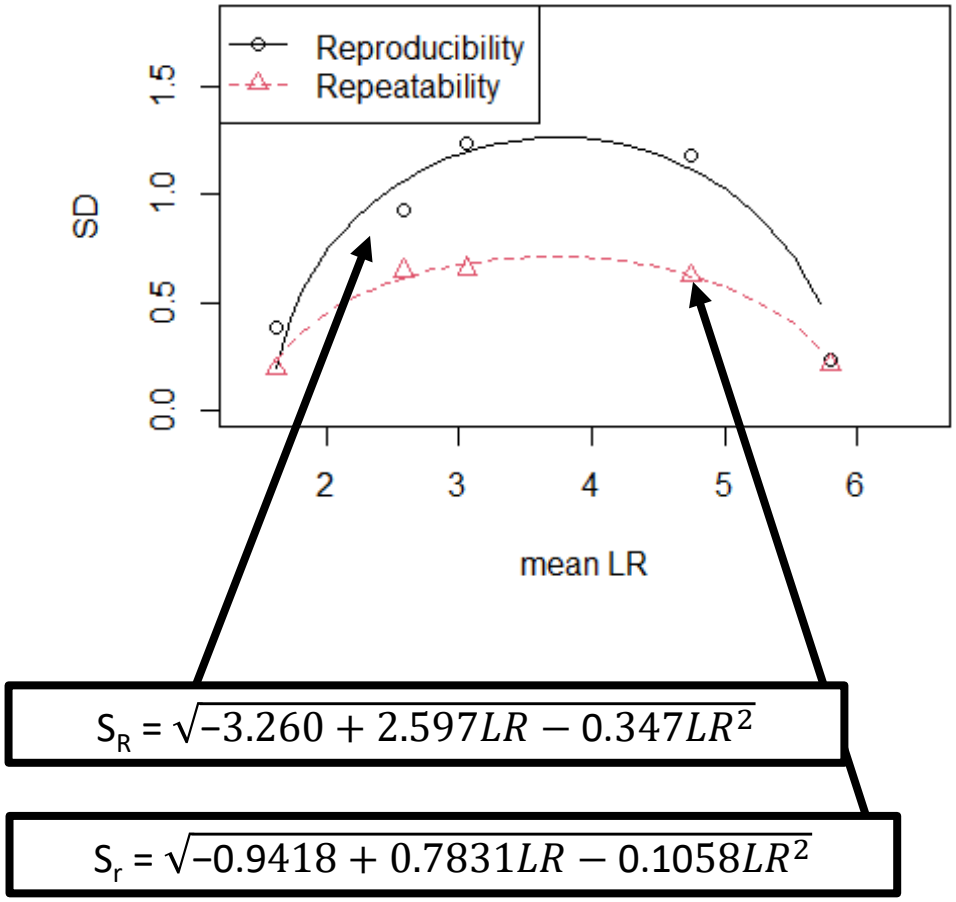
Table 3. Mean and Variability of the LRs

Microbe	Treatment	Num. Labs	Num. Tests	Mean LR	SEM	95% CI of Mean	S_R	S_r	% lab	% tests
P.a.	A	6	18	4.75	0.4339	[3.639, 5.870]	1.179	0.625	72%	28%
	B	6	18	2.58	0.3126	[1.774, 3.382]	0.930	0.646	52%	48%
	C	6	18	3.06	0.4544	[1.897, 4.233]	1.236	0.657	72%	28%
	D	6	18	1.62	0.1426	[1.256, 1.989]	0.384	0.195	74%	26%
	E	4	12	5.80	0.0764	[5.553, 6.039]	0.230	0.211	16%	84%
S.a.	A	6	18	5.31	0.3315	[4.463, 6.167]	1.055	0.825	39%	61%
	B	6	18	2.70	0.1890	[2.216, 3.187]	0.645	0.550	27%	73%
	C	6	18	2.78	0.2402	[2.159, 3.394]	0.651	0.341	73%	27%
	D	6	18	1.43	0.1407	[1.064, 1.788]	0.403	0.255	60%	40%
	E	4	12	6.21	0.0720	[5.984, 6.442]	0.165	0.099	64%	36%

Results for LR (2 of 3)

Figure 9. Reproducibility and repeatability of LR as a frown shaped function of efficacy (see [2]); graphing and interpreting the results in Table 3.

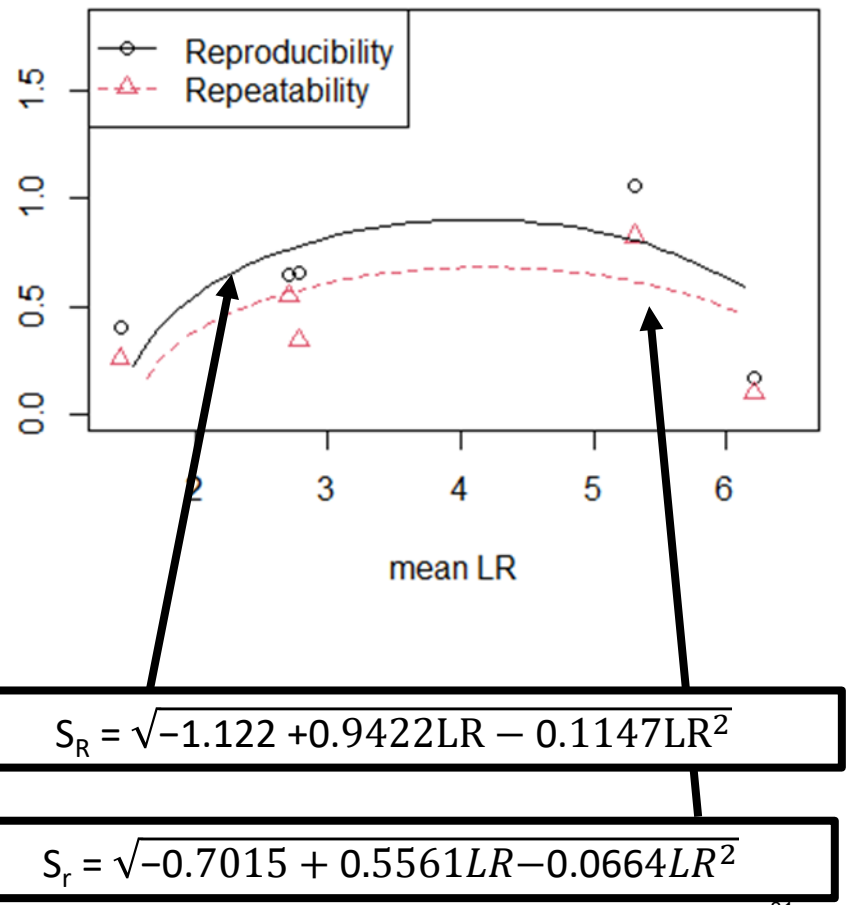
P. aeruginosa



$S_R = \sqrt{-3.260 + 2.597LR - 0.347LR^2}$

$S_r = \sqrt{-0.9418 + 0.7831LR - 0.1058LR^2}$

S. aureus

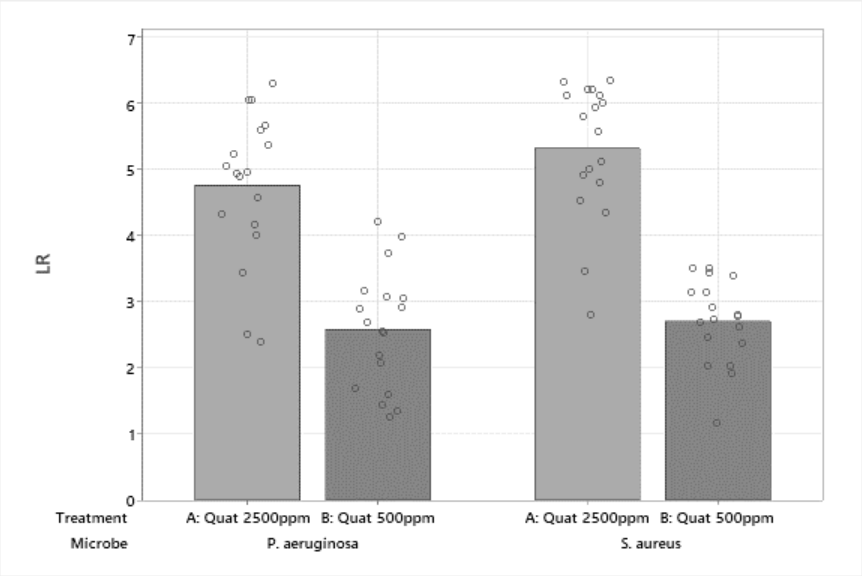


$S_R = \sqrt{-1.122 + 0.9422LR - 0.1147LR^2}$

$S_r = \sqrt{-0.7015 + 0.5561LR - 0.0664LR^2}$

Results for LR (3 of 3)

Figure 10. Responsiveness to increasing Quat concentrations (treatments A and B)



Each point is the LR (calculated from 3 control carriers and 5 treated carriers) for one test day for one treatment from one lab.

Table 4. Responsiveness to increasing Quat concentrations (treatments A and B)

Microbe	Labs	Tests	mean difference in LRs (A - B)	SEM	95% CI of Mean	*p*
P.a.	6	36	2.18	0.231	[1.70, 2.65]	< 0.0005
S.a.	6	36	2.61	0.241	[2.12, 3.11]	< 0.0005

For both microbes, the method was responsive to the increasing Quat concentration (from 500ppm to 2500ppm) as the LRs increased by 2.18-2.61 ($p < 0.0005$). See Figures 5 and 6.

Conclusions

- Across 48 tests for each microbe, the control carriers ranged from 5.05 to 6.62 for *P.a.* and from 5.54 to 6.47 for *S.a.* (Figures 1 and 2)
- The mean of the 3 control carriers from each test, *TestLD*, was 5.83 and 6.19 log(CFU/carrier) (95% CI: [5.59, 6.02] and [6.07, 6.29]) for *P.a*. and *S.a.* respectively (Table 1).
- The **reproducibility and repeatability of the controls was excellent** (CS_R = 0.295 and 0.183, CS_r = 0.228 and 0.163 for *P.a*. and *S.a*. respectively) (Table 1).
- Across the 5 treatments, the mean LRs ranged from 1.62 to 5.80 for *P.a.* and from 1.43 to 6.21 for *S.a.* (Table 3).
- **Reproducibility SDs (S_R) of the LRs differed substantially across the 5 treatments,** ranging from 0.230 to 1.24 for *P.a*. and from 0.165 to 1.06 for *S.a*. (Table 2). As expected, S_R depends on the mean LR according to a frown shaped curve so that moderately efficacious treatments have the worst reproducibility – that is, the highest reproducibility SDs (Figure 9).
- **The method was statistically significantly responsive to the change in Quat efficacy** (500ppm to 2500ppm) as the mean LRs increased from 2.58 to 4.75 for *P.a.* and from 2.70 to 5.31 for *S.a.* (Table 3).

References

1. Hamilton, M. A., Hamilton, G. C., Goeres, D. M. and Parker, A. E. Guidelines for the Statistical Analysis of a Collaborative Study of a Laboratory Method for Testing Disinfectant Product Performance. *Journal of AOAC International* 96, 1138–1151, 2013.

2. Parker, A., Hamilton, M. and Goeres, D. Reproducibility of antimicrobial test methods. *Scientific Reports* 8:12531, 2018.

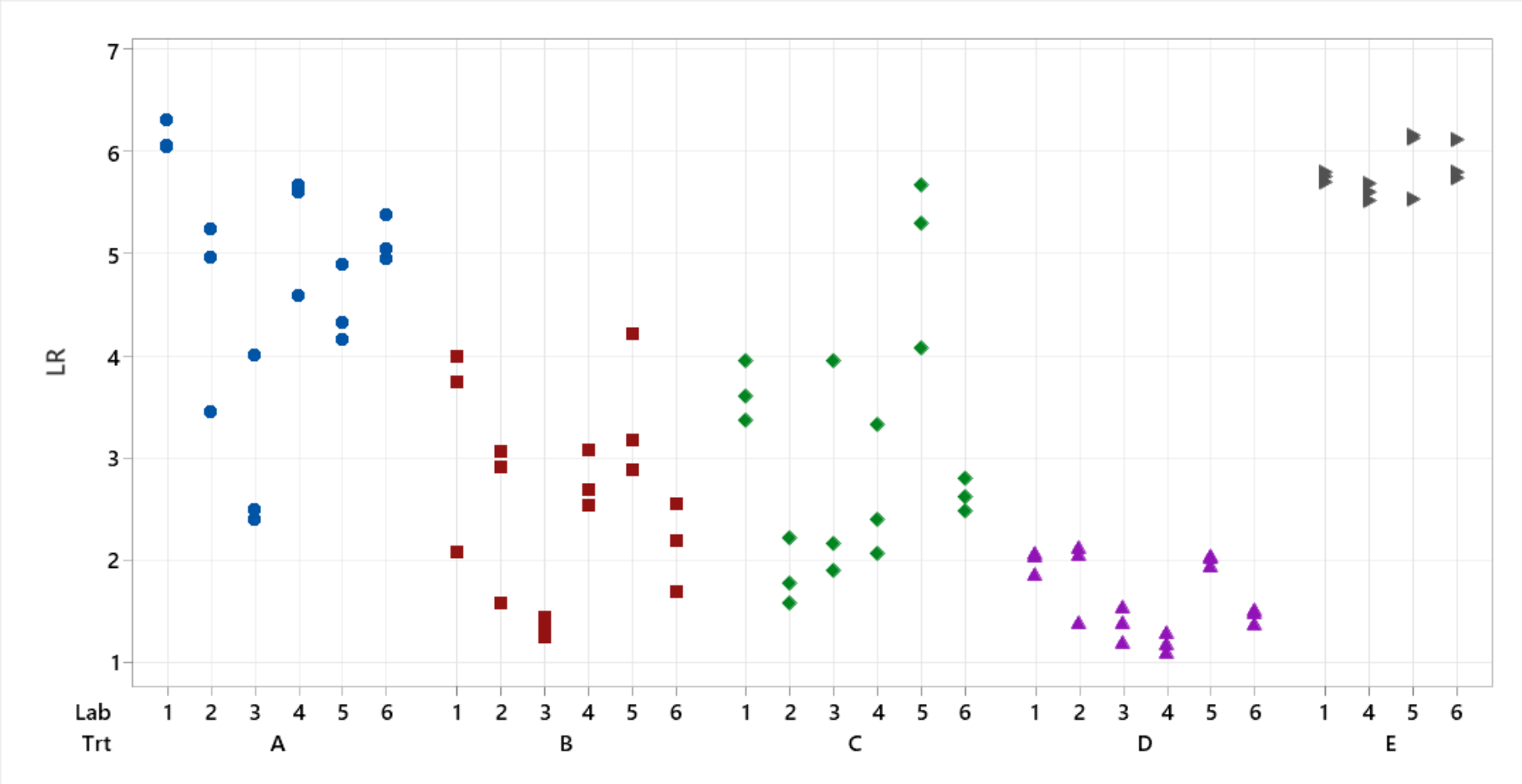
DRAFT:

Development of Testing Criteria for the Quantitative Towelette Method against *P. aeruginosa* and *S. aureus*

(Version for Docket **#EPA-HQ-OPP-2024-0414**)

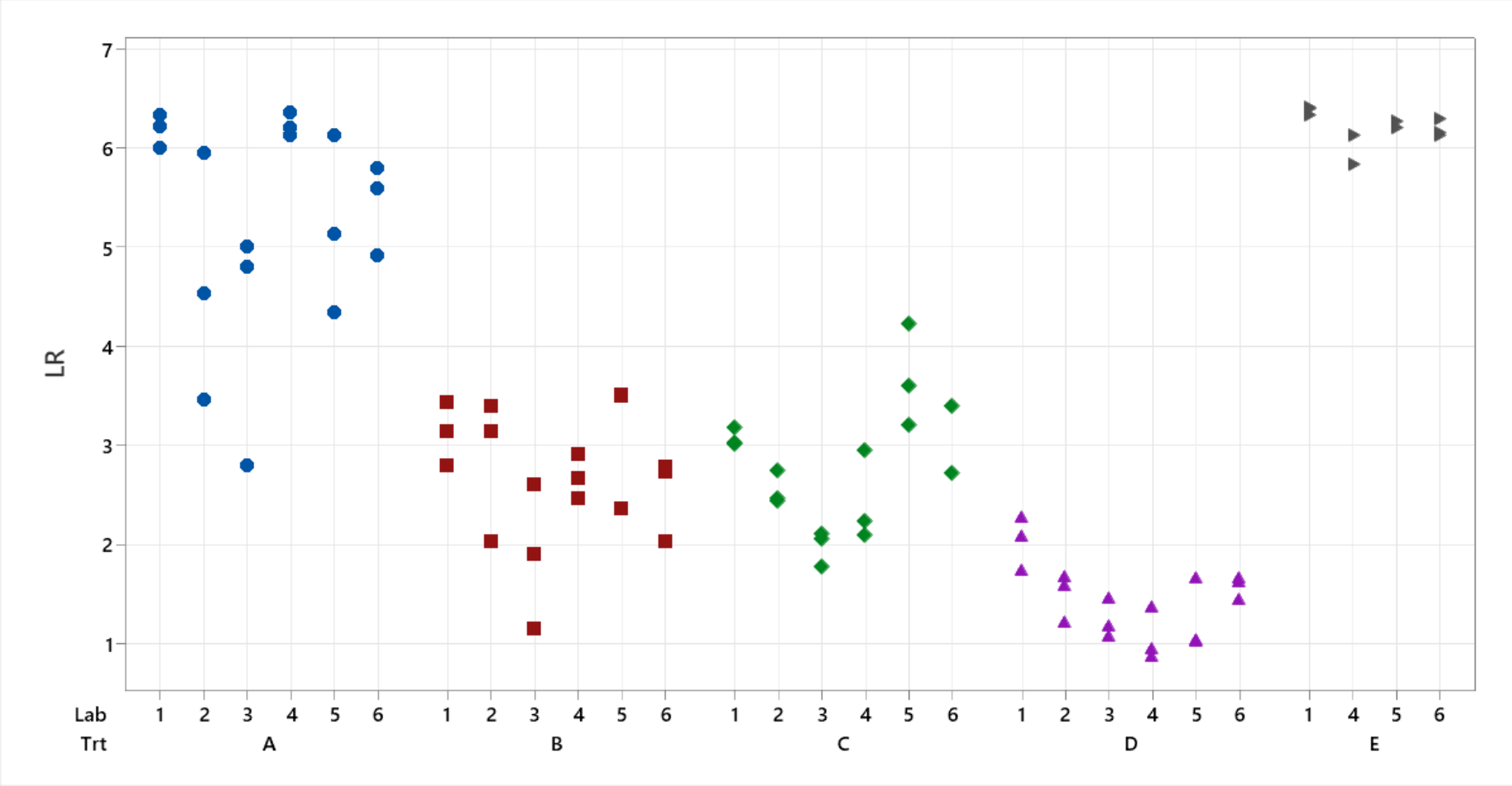
Review of log reductions from the multi-lab studies

Figure 1. *P. aeruginosa* LRs among 6 labs



Each point is the LR (calculated from 3 control carriers and 5 treated carriers) for one test day for one treatment from one lab

Figure 2. *S. aureus* LRs among 6 labs



Each point is the LR (calculated from 3 control carriers and 5 treated carriers) for one test day for one treatment from one lab

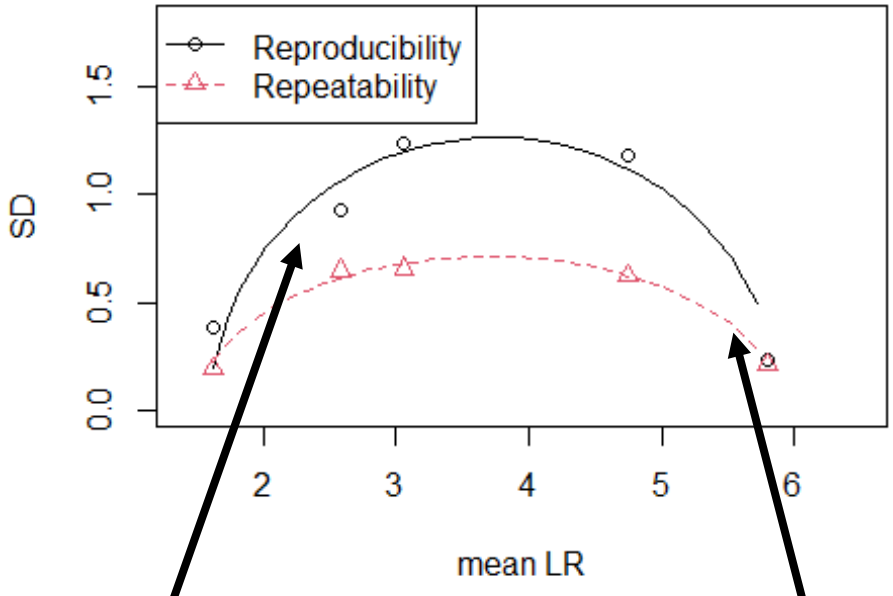
Table 1. Reproducibility among 6 labs

Microbe	Treatment	Num. Labs	Num. Tests	Mean LR	SEM	95% CI of Mean	S_R	S_r	% lab	% tests
P.a.	A	6	18	4.75	0.4339	[3.639, 5.870]	1.179	0.625	72%	28%
	B	6	18	2.58	0.3126	[1.774, 3.382]	0.930	0.646	52%	48%
	C	6	18	3.06	0.4544	[1.897, 4.233]	1.236	0.657	72%	28%
	D	6	18	1.62	0.1426	[1.256, 1.989]	0.384	0.195	74%	26%
	E	4	12	5.80	0.0764	[5.553, 6.039]	0.230	0.211	16%	84%
S.a.	A	6	18	5.31	0.3315	[4.463, 6.167]	1.055	0.825	39%	61%
	B	6	18	2.70	0.1890	[2.216, 3.187]	0.645	0.550	27%	73%
	C	6	18	2.78	0.2402	[2.159, 3.394]	0.651	0.341	73%	27%
	D	6	18	1.43	0.1407	[1.064, 1.788]	0.403	0.255	60%	40%
	E	4	12	6.21	0.0720	[5.984, 6.442]	0.165	0.099	64%	36%

Used for PS calculations

Figure 3. Reproducibility vs. mean LR

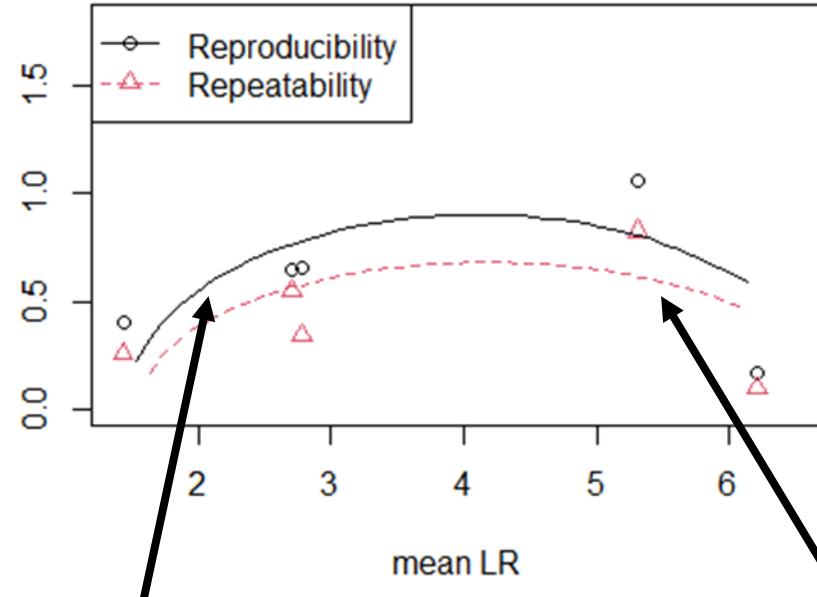
P. aeruginosa



$S_R = \sqrt{-3.260 + 2.597LR - 0.347LR^2}$

$S_r = \sqrt{-0.9418 + 0.7831LR - 0.1058LR^2}$

S. aureus



$S_R = \sqrt{-1.122 + 0.9422\mathrm{LR} - 0.1147\mathrm{LR}^2}$

$S_r = \sqrt{-0.7015 + 0.5561LR - 0.0664LR^2}$

- Each point is a SD for a single product.
- Red triangles and curve indicate repeatability SDs, black circles and curve indicate reproducibility SDs.

Table 2. Error percentages for testing scenarios against *P.a.* and/or *S.a.*

	"PASS-ALL-TEST" PS SPECIFICATION		PRODUCT DEFINITION			ERROR RATES		
Microbes	LR in each test must be larger than:	Number of Tests	Ineffective products have mean LR ≤	Effective products have mean LR ≥	Highly Effective products have mean LR ≥	Pass-error percentage	Effective Fail-error percentage	Highly effective Fail-error percentage
P.a.	4.5	1	4.0	5.0	6.0	35.1%	30.8%	<0.1%
P.a.	4.5	1	3.5	5.0	6.0	22.6%	30.6%	<0.1%
P.a.	5.0	1	4.0	5.0	6.5	22.6%	49.0%	<0.1%
P.a.	5.0	1	4.0	5.0	6.0	22.6%	49.0%	1.1%
P.a.	4.5	3	4.0	5.0	6.0	17.9%	48.6%	<0.1%
P.a.	5.0	3	4.0	5.0	6.5	9.5%	67.5%	1.4%
P.a.	5.0	3	4.0	5.0	6.0	9.5%	67.5%	2.3%
P.a.	4.5	3	3.5	5.0	6.0	9.5%	47.9%	3.1%
S.a.	4.5	1	4.0	5.0	6.0	29.5%	27.6%	0.9%
S.a.	5.0	1	4.0	5.0	6.5	14.5%	75.3%	0.5%
S.a.	5.0	1	4.0	5.0	6.0	14.5%	49.0%	6.3%
S.a.	4.5	1	3.5	5.0	6.0	14.0%	27.5%	1.2%
S.a.	4.5	3	4.0	5.0	6.0	8.7%	51.6%	2.6%
S.a.	5.0	3	4.0	5.0	6.5	2.6%	75.3%	1.4%
S.a.	4.5	3	3.5	5.0	6.0	2.6%	50.9%	3.1%
S.a.	5.0	3	4.0	5.0	6.0	2.6%	75.3%	15.0%
P.a. & S.a.	4.5	3 + 3 = 6	4.0	5.0	6.0	3.3%	69.6%	2.7%
P.a. & S.a.	4.5	3 + 3 = 6	3.5	5.0	6.0	1.7%	68.0%	3.4%
P.a. & S.a.	5.0	3 + 3 = 6	4.0	5.0	6.5	0.9%	87.0%	1.8%
P.a. & S.a.	5.0	3 + 3 = 6	4.0	5.0	6.0	0.9%	87.0%	16.3%

* To calculate error rates for PSs that require tests against P.a. and P.a. & S.a., P.a. variances were predicted from the frown-shaped curve (Figure 3) valid for mean LRs ranging from 1.62 – 5.80.The highly effective products in Table 2 outside this range with mean LR ≥ 6.0 or 6.5 are assumed to have the same predicted variance as products with mean LR = 5.8. The mean log(CFU/carrier) of the P.a. controls was 5.82.

** To calculate error rates for PSs that require tests against S.a. and P.a. & S.a., S.a. variances were predicted from the frown-shaped curve (Figure 3) valid for mean LRs ranging from 1.43 – 6.21. The highly effective product in Table 2 outside this range with mean LR ≥ 6.5 is assumed to have the same predicted variance as products with mean LR = 6.2. The mean log(CFU/carrier) of the S.a. controls was 6.18.

Table 2. Error percentages for testing scenarios against *P.a.* and/or *S.a.*

	"PASS-ALL-TEST" PS SPECIFICATION		PRODUCT DEFINITION			ERROR RATES		
Microbes	LR in each test must be larger than:	Number of Tests	Ineffective products have mean LR ≤	Effective products have mean LR ≥	Highly Effective products have mean LR ≥	Pass-error percentage	Effective Fail-error percentage	Highly effective Fail-error percentage
P.a.	4.5	1	4.0	5.0	6.0	35.1%	30.8%	<0.1%
P.a.	4.5	1	3.5	5.0	6.0	22.6%	30.6%	<0.1%
P.a.	5.0	1	4.0	5.0	6.5	22.6%	49.0%	<0.1%
P.a.	5.0	1	4.0	5.0	6.0	22.6%	49.0%	1.1%
P.a.	4.5	3	4.0	5.0	6.0	17.9%	48.6%	<0.1%
P.a.	5.0	3	4.0	5.0	6.5	9.5%	67.5%	1.4%
P.a.	5.0	3	4.0	5.0	6.0	9.5%	67.5%	2.3%
P.a.	4.5	3	3.5	5.0	6.0	9.5%	47.9%	3.1%
S.a.	4.5	1	4.0	5.0	6.0	29.5%	27.6%	0.9%
S.a.	5.0	1	4.0	5.0	6.5	14.5%	75.3%	0.5%
S.a.	5.0	1	4.0	5.0	6.0	14.5%	49.0%	6.3%
S.a.	4.5	1	3.5	5.0	6.0	14.0%	27.5%	1.2%
S.a.	4.5	3	4.0	5.0	6.0	8.7%	51.6%	2.6%
S.a.	5.0	3	4.0	5.0	6.5	2.6%	75.3%	1.4%
S.a.	4.5	3	3.5	5.0	6.0	2.6%	50.9%	3.1%
S.a.	5.0	3	4.0	5.0	6.0	2.6%	75.3%	15.0%
P.a. & S.a.	4.5	3 + 3 = 6	4.0	5.0	6.0	3.3%	69.6%	2.7%
P.a. & S.a.	4.5	3 + 3 = 6	3.5	5.0	6.0	1.7%	68.0%	3.4%
P.a. & S.a.	5.0	3 + 3 = 6	4.0	5.0	6.5	0.9%	87.0%	1.8%
P.a. & S.a.	5.0	3 + 3 = 6	4.0	5.0	6.0	0.9%	87.0%	16.3%

P.a.-only scenarios that maintain <10% pass-errors and <5% fail-errors

S.a.-only scenarios that maintain <10% pass-errors and <5% fail-errors

Two-bug scenarios that maintain <5% pass-errors and <5% fail-errors - example in previous slides

References

[1] Parker, A., Hamilton, M. and Tomasino, S. A Statistical Model for Assessing Performance Standards for Quantitative and Semi-quantitative Disinfectant Test Methods. *JAOAC International*, 97(1):58-67, 2014.

[2] Parker, A., Hamilton, M. and Goeres, D. Reproducibility of antimicrobial test methods. *Scientific Reports* 8:12531, 2018

[3] Tomasino, S., Parker, A. and Hamilton, M. Use of Statistical Modeling to Reassess the Performance Standard for the AOAC Use-dilution Methods (955.15 and 964.02) *JAOAC International*, 97(1):68-77, 2014.