Quality Field Collection Techniques for Microbial Sampling

Katie Strothman

Sanders Laboratories

TNI FAC Chair

Quality Starts in the Field

The goal is to create records that can be traced, verified, and allow the work product to be reproduced.

When that goal is achieved, the work can be defended in the face of a potentially adversarial assessment…

Without the benefit of you explaining what exactly was done.

That review may happen in a few days, weeks, months or even years!

The use of recognized, validated, and generally accepted Standard Operating Procedures ensures the creation of good records.

Session Roadmap

- Aseptic Technique Fundamentals
- Common Sampling Methods
- Typical Issues & Quick Fixes
- Transportation & Holding
- Documentation & COC Perfection

Sampling Event Workflow

PLAN &
BRIEF

PREP
SUPPLIES

COLLECT
SAMPLES

RECORD
DATA

QC CHECKS

DROP-OFF &
REVIEW

Sample Plan

-  Sample & QC Needs: Number, schedule, transport, and custody procedures
-  Method Requirements: Test methods, analytes, units, reporting/action limits, accreditations
-  Subcontractors: Contacts, agreements, and communication protocols
-  Handling & Preservation: Containers, storage, preservation, and holding times
-  Contamination Control: Decontamination, collection order, storage segregation
-  Shipping & Transport: Responsible personnel and chain of custody
-  Environmental Conditions: Impact on sample validity and mitigation plans
-  Site & Safety: Address, access, PPE, safety, and training requirements
-  Documentation: Deviations, client contracts, labeling, and regulatory compliance
-  Contingency Planning: Protocols for unforeseen situations

Pre-Event Checklist

Item	Description
Work Order Reviewed	Verify locations, sample types, tests required, dates
SOPs and Permits	Ensure latest SOPs and any required access permits are on hand
Sample Bottles/Containers	Correct types, preservatives (if applicable), expiration dates
COC Forms & Labels	Pre-filled or blank, waterproof pens, label printer if needed
Field Equipment	Calibrated instruments (chlorine, pH, etc.), batteries charged
Cooler & Ice	Clean cooler, fresh ice/ packs or dry ice (if applicable)
Field QC Supplies	Trip blanks, field blanks, duplicates, reagent water
PPE	Gloves, safety vests, boots, safety glasses, hard hats (as needed)
Decontamination Supplies	70% alcohol, bleach, wipes, clean foil
Emergency Kit	First aid kit, phone, water, sunscreen, allergy meds if needed
Weather/Route Check	Forecast reviewed, alternate routes planned

Equipment

Before Use & Documentation

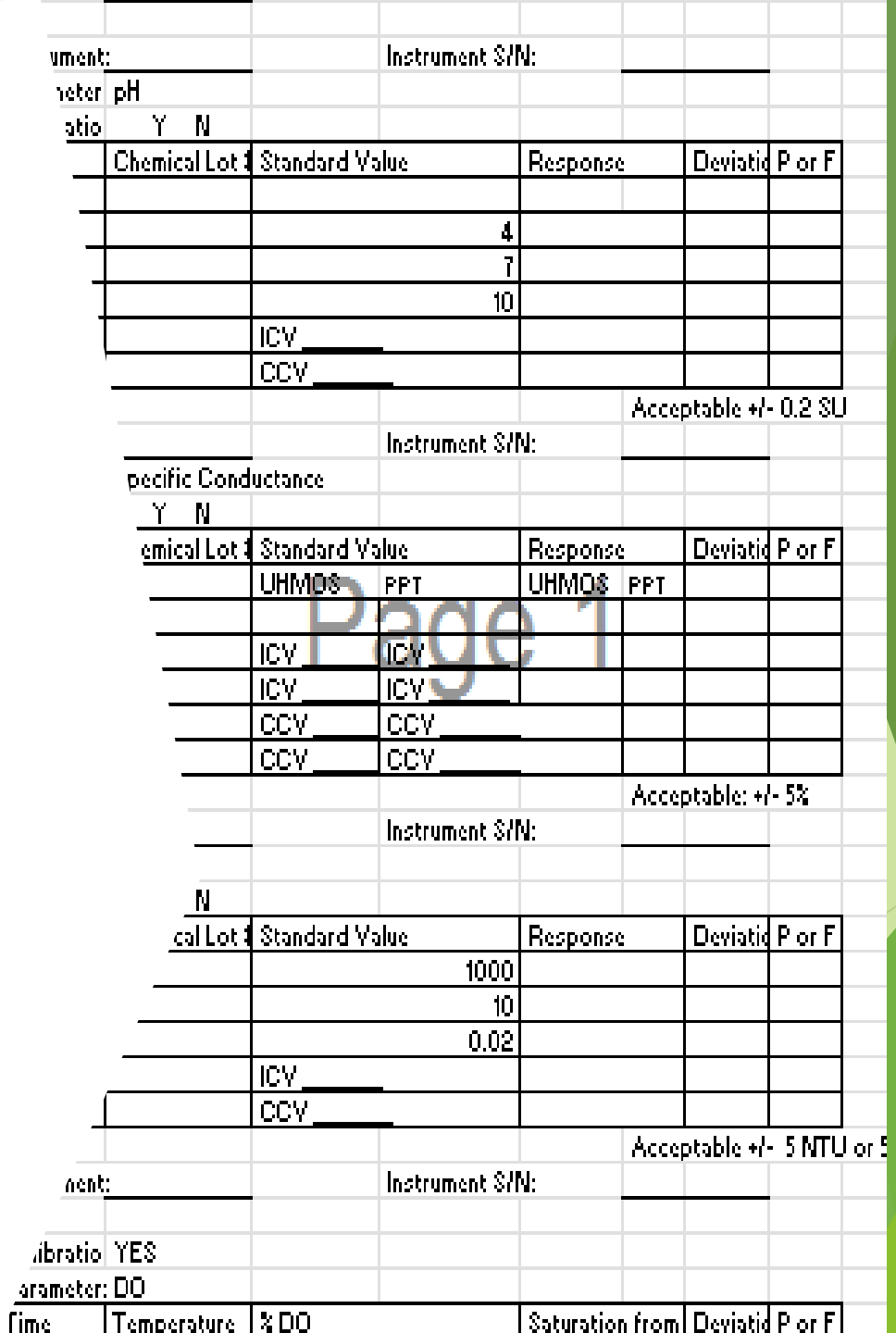
- Verify equipment meets requirements
- Document calibration method, calculations, and criteria
- Retain raw calibration data and curves
- Establish and follow acceptance criteria
- Take corrective actions if calibration fails
- Ensure off-site equipment remains compliant

Handling, Maintenance & Usability

- Set procedures for transport, storage, and use
- Maintain service intervals to detect drift
- Use independent standards for verification
- Evaluate drifted readings for usability
- Ensure unattended equipment has special protocols

Calibrations

- ICV- Lower than lowest read
- CCV- Higher than Highest read
- LCS- Around sample range
- Everyday sampling or possible data loss
- Clean your meters
- DOCUMENT



ument: Instrument S/N:
eter pH
atio Y N

Chemical Lot #	Standard Value	Response	Deviatio	P or F
	4			
	7			
	10			
	ICV			
	CCV			

Acceptable +/- 0.2 SU

Instrument S/N:

pecific Conductance
Y N

emical Lot #	Standard Value		Response		Deviatio	P or F
	UHMOS	PPT	UHMOS	PPT		
	ICV	ICV				
	ICV	ICV				
	CCV	CCV				
	CCV	CCV				

Acceptable: +/- 5%

Instrument S/N:

N

cal Lot #	Standard Value	Response	Deviatio	P or F
	1000			
	10			
	0.02			
	ICV			
	CCV			

Acceptable +/- 5 NTU or 5

ent: Instrument S/N:

ibratio YES
arameter: DO

Time	Temperature	% DO	Saturation from	Deviatio	P or F

Instrument Calibration & Use

- Daily calibration log for pH, DO, Cl meters
- Use certified standards (e.g., pH 4, 7, 10)
- Document calibration time & user
- Calibrate in clean area, before sampling

Calibration & Verification

Core Calibration Program

- Maintain and adjust calibration programs
- Document procedures with calculations & statistics
- Retain raw data (method, ID, analyte, source)
- Set criteria for verification
- Perform checks per SOP

Equipment Control & Nonconformance

- Label calibration status
- Remove or repair defective equipment
- Evaluate impact and follow nonconforming work procedure
- Perform intermediate checks
- Prevent unauthorized adjustments
- Update correction factors when required

FT 1100 pH Calibration

The acceptance criterion for the initial calibration or the calibration verification is a reading of the standard within +/- 0.2-unit of the expected value.

On a weekly basis, check the calibration to ensure the % theoretical slope is greater than 90% (if applicable to your instrument type).

- Note the % slope in the calibration records.
- A % slope of less than 90% indicates a bad electrode that must be changed or repaired.
- If % slope cannot be determined on your meter, or the manufacturer's optimum specifications are different, follow the manufacturer's recommendation for maintaining optimum meter performance.

Ft 1100 pH Samples

Measuring pH in Samples: After an acceptable initial calibration or calibration verification, follow these procedures to take a pH reading of a freshly collected sample (within 15 minutes of collection).

- **Pour enough of the fresh sample into a clean cup to take the reading.**
- **Place the pH electrode in the sample (in the cup) and swirl the electrode.**
- **Wait for stabilization, and read the pH value.**
- **Turn the meter off after the last sample reading, rinse the electrode thoroughly with de-ionized water and replace the electrode's cap.**

FT 2010 Chlorine Initial Calibration

If instrument is not already factory Calibrated

Use the primary standards (see 2.4.1 above) for initial calibration. An initial calibration must be performed if verification attempts are not successful (see 3.2.4 and 3.2.6 below).

- **Use a minimum of a blank and two standards that bracket the range of the sample measurements.**
- **If the instrument cannot be calibrated with a blank and two standards, calibrate with a blank and one standard that bracket the range of the sample measurements.**
- **Verify instruments with pre-set or factory calibrations against primary standards per 3.2.3 below.**
- **The correlation coefficient of the standard calibration curve must be greater than or equal to 0.995 for all calibrations.**

FT 2030 Initial Calibration

Initial Calibration Verification:

- Immediately after calibrating an instrument, perform an initial calibration verification by reading at least one primary standard in “read” or “run” mode as a sample.
- The value of this standard must be within quantitative calibration bracket established in 3.2.2 above. The instrument reading from this standard must be within 10% of its standard value.

FT 2030 Chlorine Residual

Perform a continuing calibration verification using at least one primary or secondary standard, by reading the standard in “read” or “run” mode as a sample. The concentration of the CCV standard should be within the initial calibration bracket established in 3.2.2 above and cannot be a zero or blank standard.

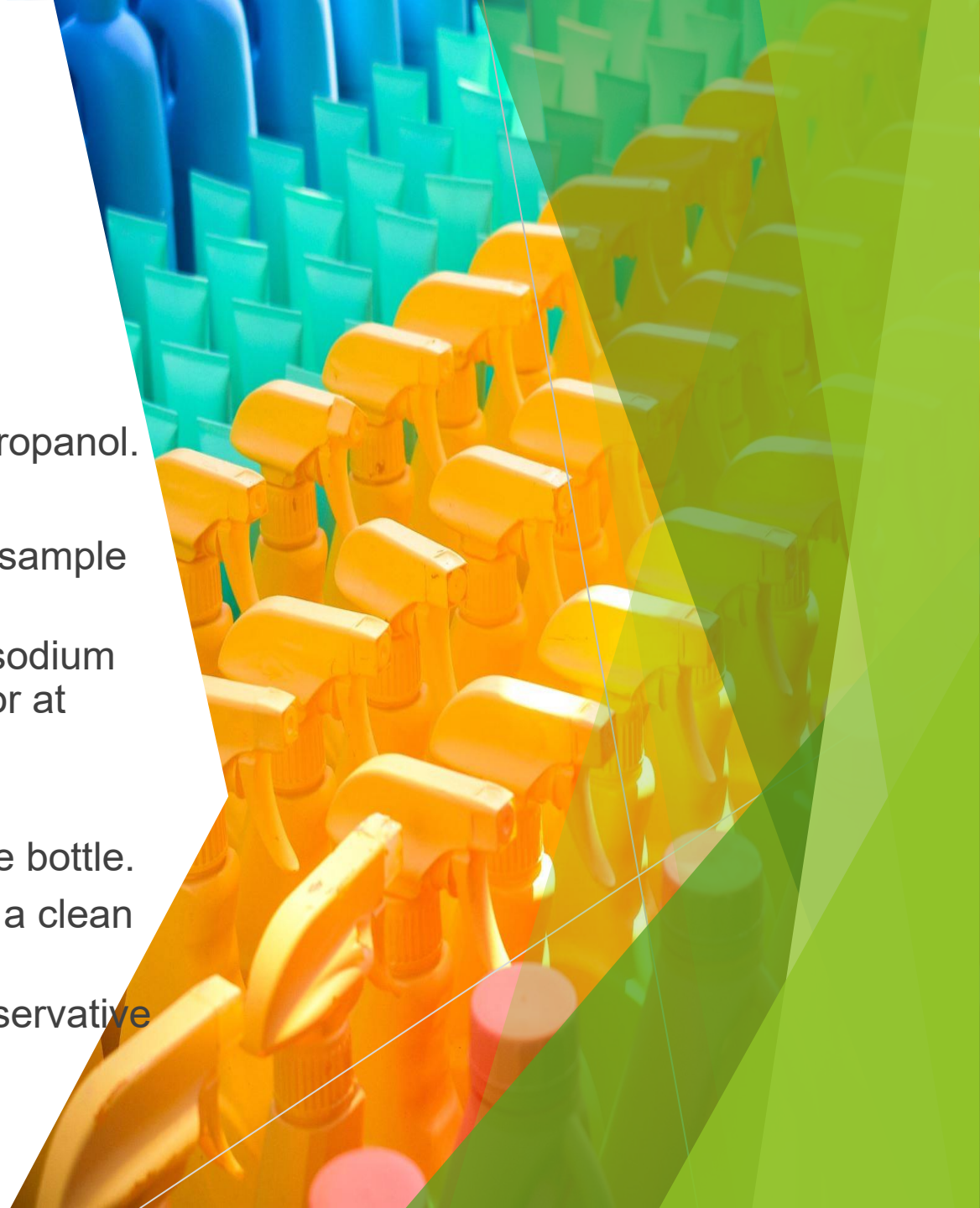
CCV measurement must be within 10% of the known standard value

Perform a CCV after the last sample measurement has been taken, but no longer than 24 hours after the previous verification

Sampling Order & Decon

- Start clean → dirtier
- Equipment rinse: 0.1 % HCl between sites
- Glove change each sample
- Store blanks on top of cooler

Aseptic Technique Fundamentals



- **Preparation Before Sampling**
- Wash hands thoroughly with soap and water or use70% Isopropanol.
- Assemble all supplies on a clean, disinfected surface.
- Wear clean, non-powdered gloves—change gloves between sample locations or if contamination is suspected.
- Disinfect sample valve/spigot: Use 70% isopropyl alcohol or sodium hypochlorite (per SOP), allow proper contact time, and flush for at least 2-3 minutes or per method/SOP.
- **Avoiding Contamination**
- Never touch the inside of sample bottles, lids, or the rim of the bottle.
- Do not place lids down—hold them facing downward or have a clean surface ready (e.g., foil or sanitized tray).
- Do not rinse the sample bottle—especially if it contains a preservative like sodium thiosulfate.

Aseptic Technique Fundamentals

- **Collecting the Sample**
- Open the bottle just before sample collection.
- Hold the bottle at a slight angle to avoid back-splash.
- Fill to the required volume (usually marked), allowing for proper headspace if instructed (especially for microbial samples).
- **Post-Collection Handling**
- Cap the bottle immediately—ensure the cap is secure but not over-tightened.
- Wipe exterior of the bottle if any spills occur.
- Label the bottle clearly with waterproof marker or pre-printed label (include site ID, date, time, sampler initials).
- Place bottle into a clean cooler with ice (not submerged in water).

Potable Water: Coliform/E. coli

Pre-Sample Checks

Review your work order and ensure correct bottle type ($Na_2S_2O_3$-preserved).

Verify expiration date on the bottle.

Record site info and date/time in field log.

Select Sample Tap

Choose a clean, dedicated sampling tap (no hoses, aerators, or swivels).

Remove any attachments and disinfect the faucet (70% isopropyl or 10% bleach). Let sit for **1 minute**, then flush tap for **2-3 minutes** (or per SOP).

Aseptic Technique

Put on clean gloves.

Avoid touching the inside of the cap or bottle rim.

Potable Water: Coliform/ E. coli **Sample Collection**

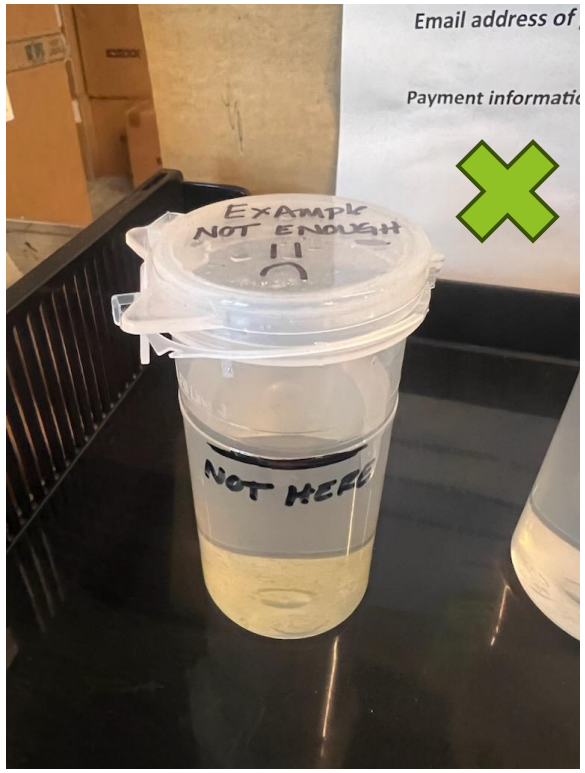
REDUCE TAP FLOW TO A GENTLE, STEADY STREAM.

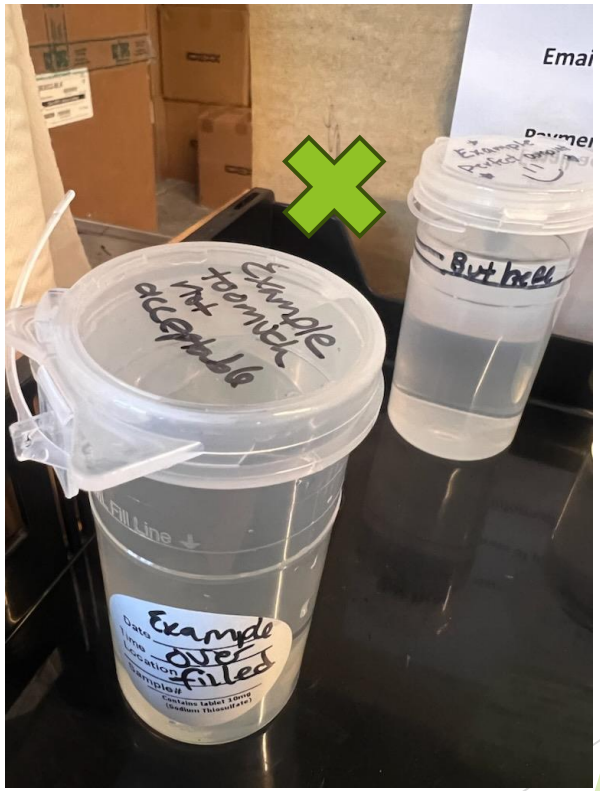
HOLD THE BOTTLE **MOUTH FACING INTO THE FLOW.**

FILL BOTTLE **TO THE ¾ MARK** (TYPICALLY ~100 ML LINE) TO ALLOW HEADSPACE FOR MIXING.

DO NOT RINSE THE BOTTLE. IT CONTAINS SODIUM THIOSULFATE TO NEUTRALIZE CHLORINE.

Just the right amount





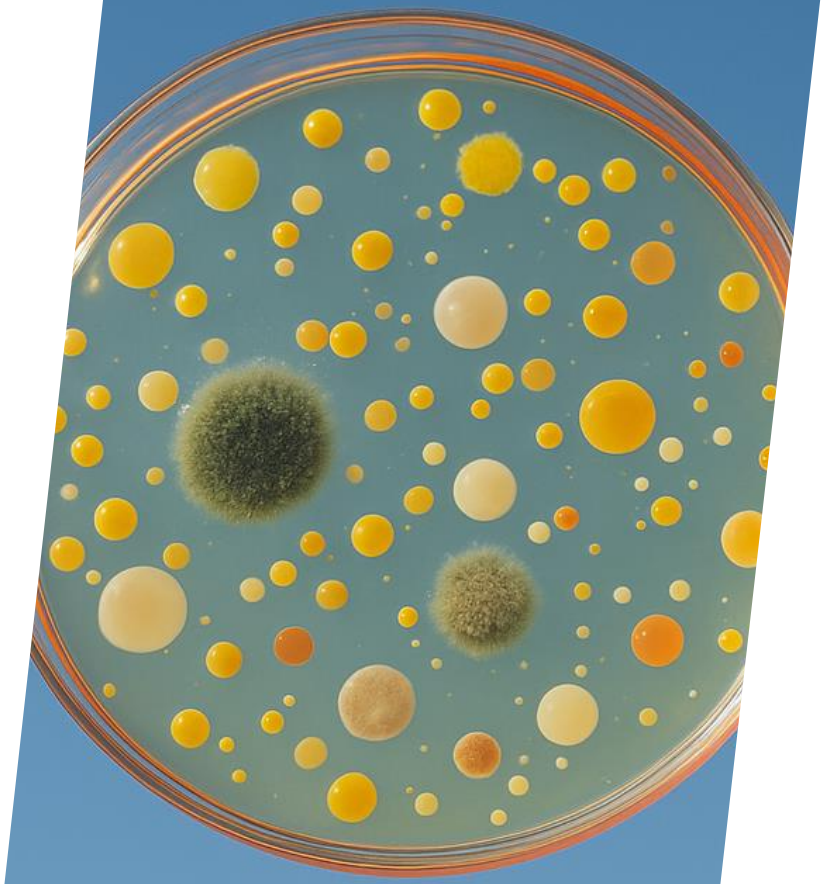
Surface Swab (FDA BAM)

Template 10×10 cm

Vertical then horizontal strokes

Sponge into 10 mL Letheen

Ship ≤24 h, 0-10 °C



Air: Bacteria & Fungi Plates

Plate Exposure

Place the agar plate on a sterile surface or tripod at breathing zone height (about 3-4 feet from the floor).

Remove lid carefully and place it face-down beside the plate (or cover loosely).

Expose the plate to air for 15-60 minutes (follow SOP for specific exposure time).

Post-Exposure Handling

Replace lid **without touching the agar** surface.

Double-check label is intact and legible.

Place plate in a clean transport container (ideally in an upright rack or box).

Soil/Sediment Microbes

Sample Collection – Soil

Use sterile scoop/spatula or corer.

Collect from top 6–12 inches unless deeper soil is specified.

Avoid touching inside of sample jar or lid.

Place ~50–100 grams of soil in sterile container (do not overfill—leave headspace).

4. Sample Collection – Sediment

For stream/lakebeds: gently insert sterile scoop or corer into the sediment.

Target undisturbed, depositional areas.

Avoid water pooling on top of sediment unless the method requires slurry.

Containers & Preservatives

- STERILE 120 ML + THIOSULFATE (MICRO)
- HDPE 500 ML + HNO_3 (METALS)
- VOA 40 ML VIALS, ZERO HEADSPACE (VOCS)
- SPONGE SWABS WITH LETHEEN (SURFACES)

Homogenization & Fill Technique

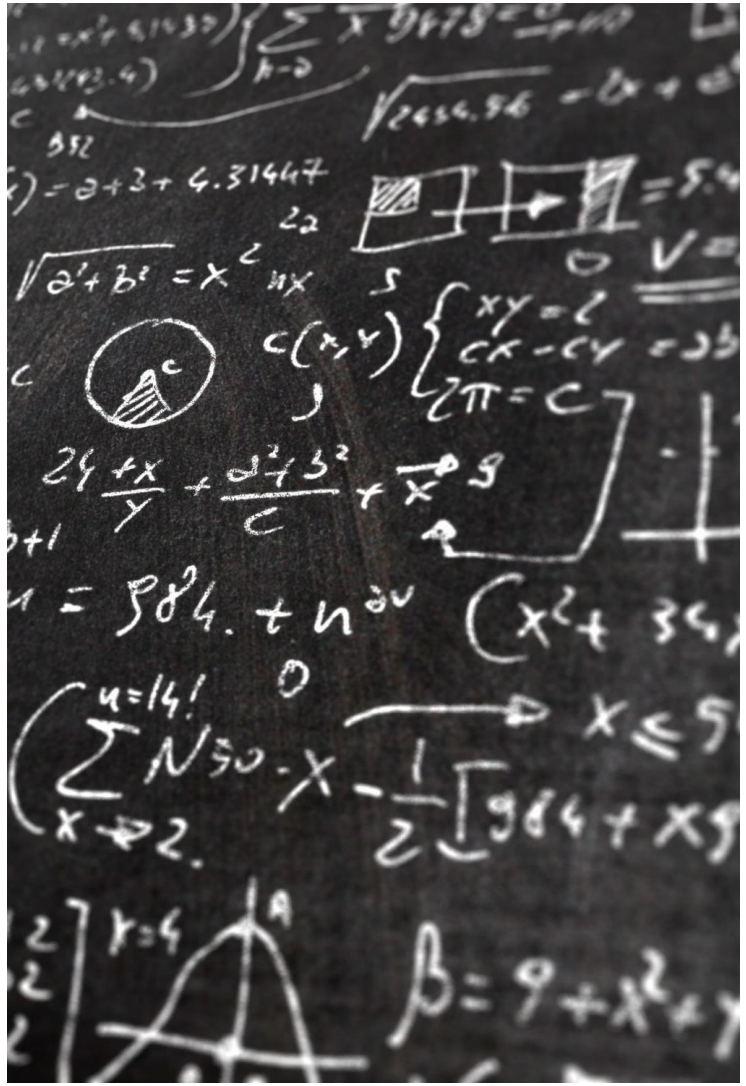
- Leave 10% headspace unless otherwise noted
- Do not overfill VOA or sterile bottles
- Shake gently or invert slowly
- Avoid pouring between containers

Transportation & Holding Times

- 0–10 °C for micro
- 6 h water/soil, 24 h swabs
- Document cooler temps on arrival
- Avoid frozen microbiological samples

Field Log Best Practices

- Ink only, no pencil or white-out
- Initials & time on every entry
- Avoid arrows or cross-outs
- Pre-label forms before field event



No Interpretation Necessary

- “Record enough information so that clarifications, interpretations, or explanations of the data are not required from the originator of the documentation.”

Field Documentation Best Practices

- Waterproof logs or tablets
- Record GPS, weather, lot # reagents
- Immediate ink signatures
- Photo of site/sample

Fill Out Label Bottle

- Site location
- Date and Time Collected
- Analysis
- Company info

Sample Receipt & Lab Acceptance

Lab checks temp, COC, label integrity

Rejection reasons: improper preservations, broken seal

Lab notes deviations on intake form


CHAIN OF CUSTODY RECORD

Phone #:
Fax #:
Project Task Code:
PO/WO #:
Analysis Requested
Sampler's (signature)
# of Bottles
Sample Method
Start Depth (m)
End Depth (m)
Sample Type
Matrix
Time
Received by Lab: (signature)
Date
Time
Shipping Method
Speedee
UPS
USPS
FedEx
Hand Delivery
Other
DOES meet proper sample storage and transportation guideline
Does NOT meet proper sample storage and transportation gui
Explain:
Rcvd on ice
Rcvd at room temp
Rcvd Temp:
Samples received same day as collection
Comments:

Perfecting the COC

Unique sample ID – no re-use

Preservative & filter logged

Relinquish & receive times

Seal cooler with tamper tape

Lab Drop-off Best Practices

Call ahead for after-hours fridge

Verify bottle integrity onsite

Signed copy of COC left with lab

Obtain receipt/temperature log

Common Field Issues & Fixes

🧪 Top Sampling Errors to Avoid

Insufficient Volume: Not meeting required volume (e.g., <100 mL for Total Coliform)

Contaminated Containers: Reusing or touching bottle rim/cap

Wrong Preservative: Using incorrect chemical or expired $Na_2S_2O_3$

Improper Aseptic Technique: Hands, sleeves, or container breaching the flow

Mislabeling or Incomplete Labels: Missing sample ID, date, or time

Incorrect Temperature Control: Sample not on ice or >10°C at receipt

Excessive Holding Time: Exceeding 6 hours for bacteria or method-specific limits

Improper Blanks & Duplicates: Missing or poorly timed field QC

Cross-contamination Between Sites: Not disinfecting hands/equipment or reusing gloves

Field QA/QC Program

- Field blank every lot/source
- Equipment blank after decon
- Duplicates 10 %
- Matrix spikes if required

Field QC Protocols

Field Blanks: DI water, test for contamination

Trip Blanks: VOC sampling transport control

Equipment Blanks: after decon between sites

Duplicates: 10% of total sample count

Matrix Spikes: where applicable by method

Field Setup: Do's & Don'ts

1. Set up on clean surface, avoid trunks and tailgates
2. Designate clean vs dirty hands
3. Never place bottle caps face-down
4. Avoid opening coolers near dusty roads

Contamination Pathways

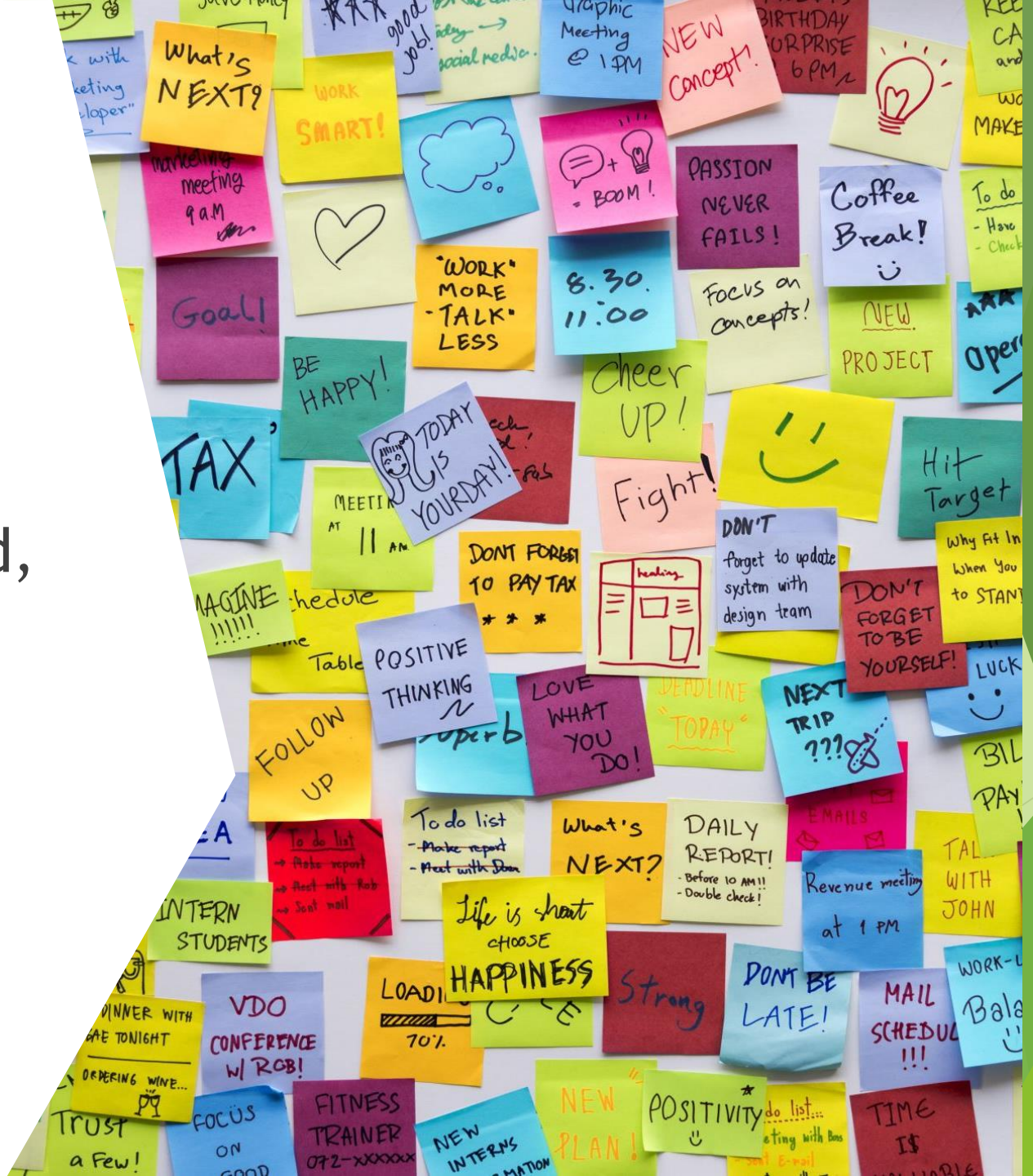
- Field sampler
- Unclean tools
- Improper gloves
- Poor storage
- Container error

Key Takeaways

- Aseptic technique = foundation
- Use correct containers & volumes
- Transport cold & fast
- Document EVERYTHING

Audit Findings: What Goes Wrong

- COC missing times or incomplete IDs
- Holding times exceeded, not documented
- Duplicate labels or illegible handwriting
- Unlogged decontamination between sites



Wrap-Up & Resources

ASK QUESTIONS BEFORE YOU SAMPLE!

YOU'RE THE FIRST LINE OF QUALITY!

Questions?

Katie@sanderslabs.net
239-590-0337